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Skeptical Inquirer

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Shadows of Science: How to Uphold Science, Detect Pseudoscience, and Expose Antiscience in the Age of Disinformation
by Kendrick Frazier

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[FROM THE EDITOR

Summer Shenanigans: Olympics, Sharks, Blockbusters, Breaks, and Trips

Summer is here, and shenanigans abound. In our cover story, Nick Tiller dives into superstition and pseudoscience used by Olympic athletes. As a former physiologist for the British Olympic Center, Tiller provides the perfect guide to watching the summer Games. Compete against your family in being the first to spot colorful tape adorning the athletes' bodies. Or, better yet, who will be the first to find evidence of cupping?

And just in time for Shark Week, we have an article from Brett Taylor on the long-extinct shark megalodon. The Discovery Channel infamously opened Shark Week with the pseudodocumentary *Megalodon: The Monster Shark Lives*, leading many viewers to believe the show's title was indeed true. Taylor identifies the key players of the modern megalodon myth and describes how their work influenced movies such as *The Meg* and *Jaws*, the latter of which propagated plenty of misinformation about sharks on its path to defining what it means to become a summer blockbuster.

Speaking of movies, Stuart Vyse's column explores critical thinking in film. Do spoilers actually spoil the cinematic experience? My daughter, Vyla—who had Han Solo's storyline in *The Force Awakens* spoiled—would surely say that they do! But research tells a more nuanced story. And if you love movies, then you'll be happy to know we're introducing a new section called "Hot Takes" in which reviewers provide brief but bold takes on new movies such as *Godzilla Minus One* (Ross Blocher), *Late Night with the Devil* (Ben Radford), and *Ghostbusters: Frozen Empire* (Kenny Biddle). Do you have a hot take on a blockbuster? We'd love to read it!

A break from school is the best part of summer for many of us, and in her article, Katharine Beals argues that it's time for schools to take a break—perhaps a permanent one—from programs designed to teach grit and growth mindset. And no summer is complete without a trip to beachy areas such as Miami, San Juan, or Bermuda. But beware: traveling between those three destinations places you right inside the Bermuda Triangle. In his column, Massimo Pigliucci explores this treacherous triangle and other tomfoolery.

Lastly, no word defines summer better than *fun*. In this issue, our "Fun & Games" section includes games related to most of the summer shenanigans described above. And for the first time, Kenny Biddle helped with that section. Speaking of games, three recent issues contain hidden five-digit codes. If you're the first to email me (shupp@centerforinquiry.org) one of the codes (along with what it represents), you'll win the unofficial prize of $50 from my personal wallet and, more importantly, your bragging rights will be cemented in print. Except for SI's editorial team, everyone is eligible to win.

—Stephen Hupp

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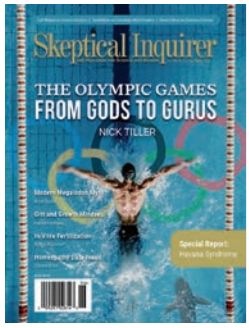

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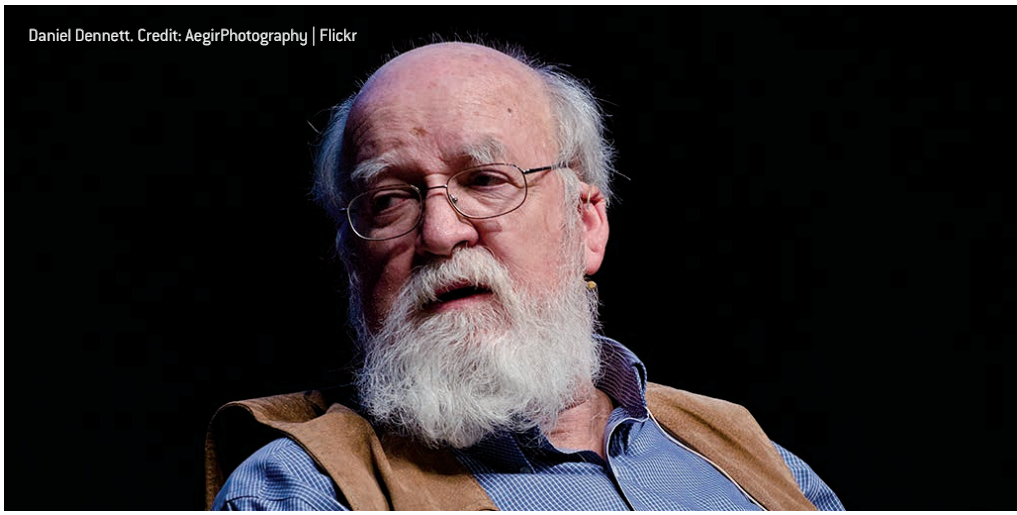
Daniel Dennett, Philosopher Who Argued about Mind and Evolution, Dies at 82

Massimo Pigliucci


Daniel Dennett. Credit: AegirPhotography | Flickr

On April 19, 2024, CSI Fellow Daniel Dennett passed away at age eighty-two. He was one of the most influential philosophers of the twentieth and early twenty-first centuries, an original thinker, and certainly someone who didn't shy from controversy.

I met Dennett many years ago, and though we didn't necessarily see eye to eye on evolution (he was a harsh critic of evolutionary biologist Stephen Jay Gould; I wasn't), he was never anything but kind to me. Indeed, he agreed to write one of the letters of support that got me my first job as a philosopher at the City University of New York, thus allowing me to complete the switch from biology to philosophy I had begun a few years earlier.

One of my best memories of him is from a long evening we spent together in Ghent, Belgium, on October 17, 2013. The event was organized by my friend Maarten Boudry, with whom I coauthored several technical papers and coedited two books.

At dinner before the event, Dennett had been very pleasant to the rest of us, behaving like a benign uncle. The event itself promised to be highly informative and entertaining. The stage was set with a lot of alcohol available to the panelists. The result, predictably, was an increasingly freewheeling and enjoyable discussion, and a good time was had by everyone.

Dennett's obituary in the *New York Times* was only partly complimentary, which surprised the hell out of me. For instance: "An outspoken atheist, he at times seemed to denigrate religion. 'There's simply no polite way to tell people they've dedicated their lives to an illusion,' he said in a 2013 interview." Well, if intellectual integrity is "denigrating," then so be it, I guess. Also: "While Mr. Dennett never held back in contradicting the views of other scholars, he bristled at harsh comments about his own work." Indeed, if by "bristling" one means responding in rhyme to accusations of intolerance.

A reviewer of the 2006 bestseller *Breaking the Spell: Religion as a Natural Phenomenon*, Leon Wieseltier, wrote that "Dennett is the sort of rationalist who gives reason a bad name." No, he wasn't, and you can read his full exchange with Wieseltier to make up your own mind (see "Breaking the Spell" in *The New York Times*).

Dennett famously proposed four rules for arguing with kindness, which he actually practiced:

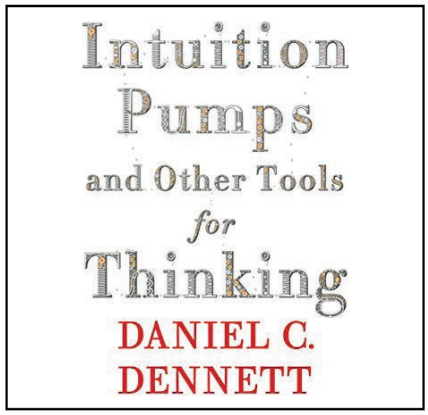
1. Attempt to re-express your target's position so clearly, vividly, and fairly that your target says: "Thanks, I wish I'd thought of putting it that way."
2. List any points of agreement (especially if they are not matters of general or widespread agreement).
3. Mention anything you have learned from your target.
4. Only then are you permitted to say so much as a word of rebuttal or criticism.

I haven't been that good myself, but I've been working toward that ideal!

In an illuminating interview with Dennett, again in *The New York Times*, published on the occasion of the release of his memoir, *I've Been Thinking*, the paper couldn't stop itself from being uncomplimentary, calling Dennett "an éminence grise of American philosophy." Oh well.

One of my favorite books of his is *Intuition Pumps and Other Tools for Thinking*, which is truly a useful guide to improve the way we reason, something that our society could most certainly benefit from. But the book that changed my entire way of thinking about mind and the perennial issue of free will is one of his early ones, *Elbow Room: The Varieties of Free Will Worth Wanting*, where he explains as clearly as anyone has ever done before or since why "free" will is not a thing but "will" is.

As an evolutionary biologist, I was not too enamored of what is arguably his most famous book, *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. Contra Dennett (and Richard Dawkins), I don't think Darwinism is a "universal acid" that cuts through everything. It's not an ideology; it's a scientific theory, and it doesn't apply everywhere but only to certain specific physical systems known



as "living." Nevertheless, this is still today a book very much worth reading.

I'll leave you with Daniel Dennett's own words: "If you can approach the world's complexities, both its glories and its horrors, with an attitude of humble curiosity, acknowledging that however deeply you have seen, you have only scratched the surface, you will find worlds within worlds, beauties you could not heretofore imagine, and your own mundane preoccupations will shrink to proper size, not all that important in the greater scheme of things" (from *Breaking the Spell*). ■

Note

This is a slightly edited version of a commentary that first appeared in Massimo Pigliucci's Substack blog, *Figs in Winter: New Stoicism and Beyond.*

Massimo Pigliucci is the K.D. Irani Professor of Philosophy at the City College of New York. Among other books, he is author of ***Nonsense on Stilts: How to Tell Science from Bunk*** (Chicago Press).

COMMENTARY]

Progress in Treatment for Obesity

REYNOLD SPECTOR

Recently, a revolutionary class of drugs (incretins) became available that cause people with obesity to safely lose as much as 25 percent of their body weight with huge secondary benefits. On November 7, 2023, the Food and Drug Administration (FDA) approved a drug called tirzepatide for the treatment of overweight and obesity (Jastreboff et al. 2022). Although there are many ways of categorizing obesity, we will define *obesity* using the body-mass index (BMI)—which is the weight in kilograms divided by the square of the height in meters; a normal BMI is between nineteen and twenty-five. A BMI of twenty-five to thirty is termed *overweight*, and greater than thirty is considered *obese*. Obesity can be due do to genetic, social, and environmental factors, such as the availability of cheap food. In some individuals, there is a so-called set point that keeps the weight stable over long periods of time. However, some people with obesity—often those in poverty—will tend to eat more, and the set point is too weak to control weight. It is now clear that obesity is a major chronic problem; 40 percent of adult Americans are obese, and 20 percent are overweight. Obesity is also becoming a major problem in children. Moreover, obesity is either causally or indirectly related to cardiovascular disease, diabetes, certain types of cancer, arthritis of the hips and knees, and premature death. There is no complete explanation for the recent increase in obesity, but one proposal is related to the evolution of humans when they were hunter-gatherers. At times when food was plentiful, those who put on more weight were possibly better able to survive famines. Thus, there is an inborn tendency to overeat when food is both inexpensive and plentiful.

In the past, often unsuccessful efforts to control obesity fell in five categories: behavioral interventions, nutritional interventions, physical activity, pharmacotherapy, and metabolic and bariatric surgery (Elmaleh-Sachs et al. 2023). Only surgical interventions could decrease weight by 20 percent or more. Now we have tirzepatide, a once-weekly self-administered subcutaneous auto-injection of up to 15 milligrams that is leading to an average sustained 20 percent weight loss over eighteen months. Thus, a person weighing 250 pounds would end up weighing, on average, 200 pounds. In the phase three trials, only 3 percent of the patients discontinued the drug because of adverse drug effects.

In humans, there are multiple factors—including hormones, peptides, and secretions by fat cells themselves—that ultimately determine weight by acting on the brain. Two targets are the Glu-

cagon-like peptide 1 (GLP-1) receptor agonists and the glucose-dependent insulinotropic polypeptide (GIP) agonists. Semaglutide, a GLP-1 receptor agonist, causes about a 10 percent decrease in body weight and is associated with fewer cardiovascular events and lower blood pressure and other unfavorable risk factors after three years of use (Lincoff et al. 2023). Tirzepatide is both a GLP-1 and GIP receptor agonist. This dual agonism probably accounts for its potency, twice that of semaglutide. It appears that these drugs will have to be taken indefinitely to maintain the weight loss, but it is also possible after four or five years the set point for one's weight might be reset, and the person may no longer require treatment. However, most patients who lose weight tend to gain it back when they go off the treatment (Aronne et al. 2024).

The economic consequences of obesity are massive. The diseases associated with obesity (cardiovascular disease, increased blood pressure, arthritis of the knee and hip, depression, lost time from work, and premature death) take a heavy toll on society; estimates of the cost of obesity are very large—perhaps $250 to $300 billion annually. Notably, the manufacturer of tirzepatide is reportedly charging approximately $1,000 a month. To control weight loss, these drugs require continuous treatment for many years, if not indefinitely. The cost for treating the 20 million Americans in the most need would be astronomically expensive at $200 billion per year. Because many of these patients are older, perhaps the government, with the new laws allowing Medicare to negotiate with drug makers, could decrease the cost by half or so. Moreover, there will be intense basic research to find a similar drug that's patentable that could be in competition. It is clear that unless there are major changes in our society, the wealthy will be in the best position to access this therapy.

The second group of issues involves individual patients and their physicians. Ideally for patients without an obvious treatable cause, such as Cushing's disease, a reasonable physician after finding the patient unable to lose weight via other means would want to try tirzepatide. When patients do lose substantial weight, there is an associated danger. Patients may feel they can now eat more, and such a choice may neutralize some of the drug's effects. In clinical trials, patients are closely watched and counseled about diet, and the fact that the research results may not reflect what will happen in the real-life use of the drug.

In summary, American society has multiple issues to deal with in terms of treatment of obesity; first is the cost. How much are Americans, society, government, and insurers willing to pay for this very expensive treatment for a chronic condition affecting over 100 million Americans? Because not everyone can be treated, how will the treatment allocation be handled? Another question is how soon competitors will develop similar drugs that will allow for substantially lowering the cost. Tirzepatide is a potent and complex drug. Moreover, its manufacturer, Lily, has another drug (retatrutide) that is a GLP-1, GIP, and glucagon agonist that in phase 2 trials caused a 25 percent weight loss versus 20 percent for tirzepatide. Lily recently purchased the company Versanis, which has the weight loss drug bimagrumab. It may be difficult to compete with Lily for years, further complicating equitable distribution for the individual patient. Investors have noted the potential value of Lily's weight loss drugs is so great that Lily is now the largest drug company. Thus, we now know what can be done, but doing it on the scale required will be difficult and expensive and will require superb presidential, congressional, and pharmaceutical leadership. ■

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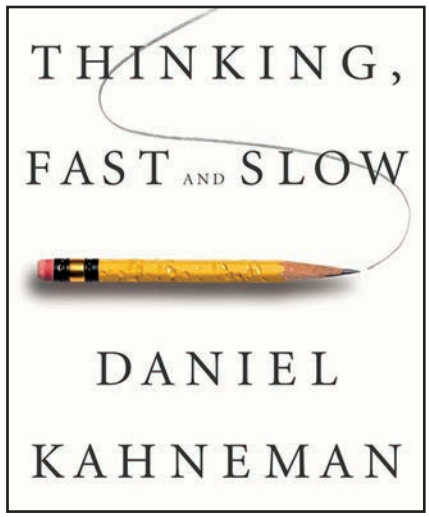
Daniel Kahneman, Behavioral Economics Nobel Laureate, Dies at 90

Jonathan C. Pettibone

Daniel Kahneman. Credit: World Economic Forum | Flickr



On March 20, 2024, one of the most influential thinkers in behavioral research, Daniel Kahneman, died at age ninety. In a 2014 *Guardian* article, Steven Pinker said, "I've called Daniel Kahneman the world's most influential living psychologist and I believe that is true."

Kahneman's work with Amos Tversky and others in the development of the heuristics and biases literature of the 1970s and 1980s defined the nascent field of judgment and decision making, giving birth to behavioral economics as a pursuit distinct from economics. The fundamental idea that human judgment and choice did not tend to be rational (in the formal economic sense) was an idea that generated a multitude of research and inspired generations of researchers across psychology and economics. One of the more enduring ideas from his work was the concept of loss aversion (the observation that people are often more likely to work to avoid a loss than to achieve a gain) as a part of prospect theory.

Kahneman was honored for the body of this work in 2002 with the Nobel Prize in Behavioral Economics, an award he shared with Vernon Smith. In his book *Thinking, Fast and Slow*, he expanded on and summarized prior research by proposing the system one/system two hypothesis. This approach suggests that we possess both a fast, automatic route to judgment as well as a slow, effortful path with the choice of path contributing to the biases we observe in decision making. Decisions made using system one can be efficient but often lead to the biases and variation in the outcomes we observe in ourselves and others. Decisions made using system two can be more accurate—but at the cost of time and resources.

Kahneman also made notable contributions to our understanding of happiness and the never-ending pursuit of life satisfaction. For his work, he received the Presidential Medal of Freedom in 2013, and across his life he served as an example of the value of skepticism and intellectual humility in the pursuit of knowledge. In an article for Skeptical Inquirer, Stuart Vyse wrote:

> Like most academic psychologists, Kahneman has had his share of disagreements with other researchers, but unlike almost all other academic psychologists, Kahneman has sought to engage with his rivals in an effort to find a sensible resolution. The subject of his Edge.org talk was "adversarial collaboration," a strategy in which researchers who are at odds with each other agree to collaborate on the design of experiments that they both acknowledge have the potential to resolve the issues at hand. … In my view, Kahneman's gentle manner and his "make love not war" approach to scientific conflicts are two of the many reasons he is held in such great esteem" ("Eat Popcorn: The Current State of the Priming 'Train Wreck,'" November/December 2022).

In another SI article, Scott O. Lilienfeld praised Kahneman for his intellectual humility: "If only all scientists and politicians were this willing to own up to their errors!" ("Intellectual Humility: A Guiding Principle for the Skeptical Movement?" September/October 2020).

Kahneman's insight and wisdom will be greatly missed but will influence skeptical thinkers for generations to come. ■

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News Bites: From the Satanic Panic to the Ant Who Must Not Be Named

Margaret Polk, Stephen Hupp, and Jason Finley

Bennett Braun, Satanic Panic Provoker, Dies at 83. Bennett Braun died on March 20, 2024. Best known as a satanic conspiracy theorist, Braun made a name for himself by diagnosing patients with multiple personality disorder (now known as dissociative identity disorder), supposedly affected by repressed memories. He treated patients with medication and hypnosis, leading to false memories of being in a satanic cult and murdering others. Braun was sued for malpractice and had his medical license revoked. (For more, read "Bennett Braun: The Psychiatrist Who 'Fueled' the Satanic Panic" at skepticalinquirer.org.)

Samuel Bankman-Fried, Cryptocurrency Mogul, Sentenced to 25 Years. On March 28, 2024, Samuel Bankman-Fried was sentenced to twenty-five years in prison for multiple fraudulent cryptocurrency schemes. He was also ordered to pay an $11 billion penalty. Bankman-Fried defrauded over $8 billion from his customers by encouraging them to invest in an international cryptocurrency exchange as part of their investment portfolios. He claimed that customers' money was being kept separate from the research and investments the company made but instead misappropriated the funds. (For more, read "Samuel Bankman-Fried Sentenced to 25 Years for His Orchestration of Multiple Fraudulent Schemes" from the Office of Public Affairs.)

Steven Jay Lynn, Psychology Myth Buster, Dies at 78. Steven Jay Lynn died on March 29, 2024. A prolific scholar, he published many books along with CSI Fellow Scott O. Lilienfeld. A few of their most influential books include *Science and Pseudoscience in Clinical Psychology*, *Psychology: From Inquiry to Understanding*, and *50 Great Myths of Popular Psychology: Shattering Widespread Misconceptions about Human Behavior.* Lynn published widely on topics such as psychopathology, psychotherapy, memory, and hypnosis. (For more, search for Steven Jay Lynn at legacy.com.)

Peter Higgs, 'God Particle' Nobel Laureate, Dies at 94. Peter Higgs died on April 8, 2024. He first suggested the existence of a new particle, now called the Higg's boson (and more popularly called the God particle). As stated on the website for the Nobel Prize, Higgs and François Englert shared the Nobel Prize in Physics in 2013 "for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider." (For more, read "Peter Higgs, Nobelist Who Predicted the 'God Particle,' Dies at 94" in the *New York Times*.)

Solar Eclipse Science and Wonder. On April 8, 2024, a much-anticipated total solar eclipse swept across the United States, mesmerizing millions in the path of totality. The Moon occluded the Sun for several minutes in the middle of the day, treating onlookers to the breathtaking sight of the Sun's corona billowing in wispy white streams and even a few red solar prominences. Temperatures dropped, shadows misbehaved, and wild birds briefly sang their evening songs before regaining composure. During the eclipse, more than 36,000 citizen scientists helped NASA collect valuable data. (For more, see "More than 36,000 Volunteers Helped Do NASA Eclipse Science" from science.nasa.gov).

New Animal Discovery: The Ant Who Must Not Be Named. On April 11, 2024, the journal *ZooKeys* published the discovery of a new Australian ant called *Leptanilla voldemort* named after Harry Potter's nemesis. This ant's distinctive features include a slender, ghostly appearance due to the underground environment it inhabits. (For more, see "Ant Species Named after Harry Potter Villain Lord Voldemort after Pilbara Discovery" from the Australian Broadcasting Corporation.) ■

Margaret Polk, Stephen Hupp, and Jason Finley are all professors of psychology at Southern Illinois University Edwardsville.

The Eclipse

JOE NICKELL

The pen
pirouettes
for
a metaphor,
as if a pirate's
black-
patched
eye crowds in,
in search
of the gleaming
gold
coin
of the sun.
Of a sudden,
spilled
ink
turns
day to night,
then
back to light
again,
while
beneath,
wonderment
everywhere
scatters,
at last unleashed.

COMMENTARY]

Data Falsification, Fabrication, and Manipulation by a Prominent Homeopath

EDZARD ERNST

Most readers of this magazine probably agree that homeopathy is a placebo therapy. Its assumptions fly in the face of science, its remedies are normally devoid of active ingredients, and the evidence from clinical trials is uniformly negative (Ernst 2016).

Hold on—this is not entirely correct; there are plenty of clinical trials of homeopathy that arrived at a positive conclusion (Mathie et al. 2014). How come? Why do some studies of homeopathy show positive outcomes? Skeptics usually claim that this is because these studies are not rigorous; they are not randomized, not double blind, or not placebo-controlled. But even this assumption is not quite true. In 2020, Frass et al. published a widely reported trial that seemed to prove the assumption wrong. Here is its abstract:

> *Background:* Patients with advanced non-small cell lung cancer (NSCLC) have limited treatment options. Alongside conventional anticancer treatment, additive homeopathy might help to alleviate side effects of conventional therapy. The aim of the present study was to investigate whether additive homeopathy might influence quality of life (QoL) and survival in patients with NSCLC.
>
> *Methods:* In this prospective, randomized, placebo-controlled, double-blind, three-arm, multicenter, phase III study, we evaluated the possible effects of additive homeopathic treatment compared with placebo in patients with stage IV NSCLC, with respect to QoL in the two randomized groups and survival time in all three groups. Treated patients visited the outpatients' centers every 9 weeks: 150 patients with stage IV NSCLC were included in the study; 98 received either individualized homeopathic remedies (n = 51) or placebo (n = 47) in a double-blinded fashion; and 52 control patients without any homeopathic treatment were observed for survival only. The constituents of the different homeopathic remedies were mainly of plant, mineral, or animal origin. The remedies were manufactured by stepwise dilution and succussion, thereby preparing stable Good Manufacturing Practice grade formulations.
>
> *Results:* QoL as well as functional and symptom scales showed significant improvement in the homeopathy group when compared with placebo after 9 and 18 weeks of homeopathic treatment ($p < .001$). Median survival time was significantly longer in the homeopathy group (435 days) versus placebo (257 days; $p = .010$) as well as versus control (228 days; $p < .001$). Survival rate in the homeopathy group differed significantly from placebo ($p = .020$) and from control ($p < .001$).
>
> *Conclusion:* QoL improved significantly in the homeopathy group compared with placebo. In addition, survival was significantly longer in the homeopathy group versus placebo and control. A higher QoL might have contributed to the prolonged survival. The study suggests that homeopathy positively influences not only QoL but also survival. Further studies including other tumor entities are warranted. (Frass et al. 2020)

This study seemed rigorous because it was randomized, placebo-controlled, and double blind; it was published in a reputable journal; and it was conducted by a well-known expert. The lead author of the study, Michael Frass, was a respected professor at the Vienna Medical School (the institution to which I too once belonged).

Michael Frass. Credit: Own Website | ordination-frass.at

When I first discussed his trial, I was nevertheless suspicious (Ernst 2020), not least because I had previously disclosed that Frass had published no fewer than twelve studies of homeopathy—all

of which arrived at positive conclusions (Ernst 2015). Soon after the publication of Frass's new trial, an in-depth analysis by Norbert Aust and Viktor Weisshäupl disclosed several important inconsistencies (Ernst 2021). They prompted complaints to both the journal *The Oncologist* and the Vienna Medical School about suspected scientific misconduct. The Medical School then referred the case to the Austrian Agency for Scientific Integrity. They took their time, but recently—more than three years after the Frass study was published—they made available the final online summary of their assessment. Here is my translation of this document:

> After an Austrian university was informed externally, and by name, of possible scientific misconduct in a study and the resulting publication, the institution concerned submitted the already-publicized suspected case in the field of applied natural sciences to the OeAWI with a request for examination by the Commission.
>
> After establishing sufficient suspicion of various violations of good scientific practice, the Commission declared itself responsible and initiated proceedings. In the course of this, the principal investigator was given the opportunity to submit a written statement and to provide the Commission for Research Integrity Annual Report 2022 material that would help to clarify the facts of the case, which the accused submitted in large quantities.
>
> In a very complex, comprehensive investigation, which required, among other things, the on-site inspection of original documents, the Commission was able to substantiate the suspicion of data falsification, fabrication and manipulation. In a final statement, the study director, who no longer works for the university in question, and the numerous co-authors were informed in detail about the course and results of the commission's investigation and informed of the recommendations to the university and journal. The Commission recommended that the university concerned should consider investigating its own responsibilities and act accordingly, and that the publication should be withdrawn as a matter of urgency. The journal responsible for the publication was asked to withdraw the publication on the basis of the findings of the investigation. (OEAWI 2022)

I do, of course, applaud the Austrian Agency for Scientific Integrity for their thorough assessment. But I do also have some criticism: health fraud in this area can easily cost lives. I find it therefore unacceptable that the verdict took so long to get published. Even worse, in my view, is the fact that *The Oncologist* is still offering the paper as of this writing, albeit with the following "expression of concern":

> This is an Expression of Concern regarding: [Frass et al 2020] …
>
> In August 2022, the journal editors received credible information from the Austrian Agency for Research Integrity about potential data falsification and data manipulation in this article. While *The Oncologist* editorial team investigates and communicates with the corresponding author, the editors are publishing this Expression of Concern to alert readers that, pending the outcome and review of a full investigation, the research results presented may not be reliable. (Expression of Concern 2022)

Back to my initial question: Why do some studies of homeopathy show positive outcomes? Does the Frass case demonstrate that it is all down to scientific misconduct or outright fraud? In the realm of homeopathy, I certainly find scientific misconduct with some regularity (Ernst 2019a; 2019b; 2019c). Yet, there are at least two further reasons for positive results:

- Some homeopathic remedies are not highly diluted and might therefore have pharmacological activity.
- Many of the positive trials are wide open to bias (which renders them false-positive).

The problem is that the difference between bias and fraud is often blurred. In many instances, authors seem to deliberately hide their biases so well that even intense scrutiny is unable to identify them in the published paper. This behavior is alarmingly prevalent in the realm of so-called alternative medicine (SCAM), and I would argue that it should also be categorized as fraud. ■

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Edzard Ernst is emeritus professor, University of Exeter, United Kingdom, and author of several books, including the forthcoming *Bizarre Medical Ideas … and the Strange Men Who Invented Them*.

SPECIAL REPORT]

Smoke and Mirrors: The *60 Minutes* 'Breakthrough' on Havana Syndrome Exposed

ROBERT E. BARTHOLOMEW

Never let facts get in the way of a good story.

—author unknown

Since 2019, journalist Scott Pelley has broadcast several segments for the CBS News magazine *60 Minutes* on the so-called mystery of "Havana Syndrome"—an array of health complaints reported by American diplomats and intelligence officers since late 2016 that have been attributed to a directed energy weapon. Each of these programs has promoted the notion that American diplomats appear to have been victimized by a nefarious foreign actor. The most recent episode aired on Sunday, March 31 (Pelley 2024). The problem with these reports is that they intentionally omit vital information that would have cast serious doubt on the veracity of the claim that American citizens are under attack. And while there is nothing wrong with engaging in speculation, they have left out opposing views. There were eight interviews—and zero skeptics. Like a compelling Bigfoot or UFO documentary, they have stacked the deck to lead the audience to reach a particular conclusion. In this report, I show how CBS News ginned up this issue by engaging in deception by omission.

David Relman

A key figure in the segment is Stanford microbiologist Dr. David Relman, who oversaw a panel that concluded pulsed microwave radiation was a likely cause for "anomalous health incidents" in American diplomats and intelligence officers. Relman said in an interview on the segment that his panel found "clear evidence of an injury to the auditory and vestibular system of the brain." The vestibular system is responsible for balance, depth perception, and spatial awareness. Relman's claim is not supported by the findings of two recent National Institutes of Health studies that found no evidence of brain damage in patients who were identified as having Havana Syndrome (Chan et al. 2024; Pierpaoli et al. 2024). In one of the studies, Dr. Leighton Chan and his colleagues identified 41 percent of victims as meeting the criteria for functional neurological disorders (FNDs) where the signals to the brain become disrupted. There is nothing structurally wrong with the brain itself. A common cause of FNDs is stress—to which no one is immune, not even highly trained and educated government workers. Mass psychogenic illness is one form of FND. As for what could have caused the stress, soon after the diplomats and intelligence officers were posted to Cuba in 2015 and 2016, they were warned they may be the target of a sonic weapon—a stressful situation by any standard. They were even cautioned not to stand or sleep near windows. While earlier studies in 2018 and 2019 suggested the presence of mild traumatic brain injury in some patients, they lacked adequate control groups for comparison, unlike the much more rigorous National Institutes of Health (NIH) studies. Those earlier studies were also riddled with methodological flaws (Bartholomew and Baloh 2024). For instance, Relman's panel rejected the possibility that many of the victims were

suffering from mass psychogenic illness because they had received security training and could presumably handle stress. This is a fallacy; anyone can—and most people do—experience this condition. This is Mass Psychogenic Illness 101; it is hard to see how the panel missed something so basic.

The findings of Relman's 2022 panel report are not supported by the conclusions of five intelligence agencies that found his suggestion of attacks "highly unlikely" (Office of the Director of National Intelligence 2023). It is not hard to see why there was disagreement. His panel report was filled with unsupported claims, and the list of experts they interviewed was stacked with believers and rogue scientists. One, Dr. Beatrice Golomb, once told me that psychogenic illness could not have been involved in the victims in Cuba because there was no evidence that the subjects *colluded to feign their symptoms*. This shows an alarming and fundamental lack of understanding about the nature of psychogenic illness. When I pushed her to clarify, she told me she thought that mass psychogenic illness was a myth (Golomb 2020)! Another panel interviewee, Dr. Michael Hoffer of the University of Miami, has made sensational claims about vestibular damage in a study he led (Hoffer et al. 2018). But UCLA neurologist Dr. Robert Baloh, who has written the standard textbook in the field of vestibular neurology and created some of the tests used to assess Havana Syndrome patients, says Hoffer's study had major flaws and showed nothing of the sort (Baloh and Bartholomew 2020). Baloh's claim was supported by the recent NIH studies that found no inner ear damage in patients (Chan et al. 2024). In 2011, *Time* magazine reported that Hoffer was under investigation by the U.S. Navy for a series of charges including "research misconduct" (Thompson 2011). These are red flags.

Scott Pelley also talked to an ex-U.S. military intelligence officer who headed the Pentagon investigation into Havana Syndrome. Gregory Edgreen said the impact on American national security has been devastating, because "the intelligence officers and our diplomats working abroad are being removed from their posts with traumatic brain injuries—they're being neutralized." The problem with this statement is that this is one man's opinion and is not supported by the conclusions of the American intelligence community, which has deemed Havana Syndrome to be a catch-all category that encompasses a variety of health conditions, stress reactions, and environmental factors that have been placed under a single label (Office of the Director of National Intelligence 2023).

'Attack' in Lithuania

During 2023's NATO Summit in Lithuania, Pelley said that "multiple officials tell us that a senior official of the Department of Defense was struck by the symptoms and sought medical treatment." The problem with this claim is that the symptoms of Havana Syndrome are both varied and vague. They include headache, nausea, dizziness, fatigue, difficulty concentrating, difficulty seeing, forgetfulness, confusion, disorientation, tinnitus, insomnia, balance problems, head pressure, and ear pain. The symptoms often touted in media reports—brain injury and hearing loss—have never been demonstrated in any rigorous study. So, when Scott Pelley says a military official "was struck by the symptoms," it's hard to know which health complaints he is referring to. Not only are these symptoms common, but they are features of hundreds of different, unrelated medical conditions.

It's the Russians

Pelley points the finger of blame at a special Russian military unit known as 29155. It was disclosed that a Russian journalist had found a document where one of the unit's officers had been paid for his work on "nonlethal acoustic weapons." First, *acoustic* weapons involve sound, not microwaves, which is supposedly the weapon involved. Second, acoustic weapons known as long-range acoustical devices (LRADs; or sound cannons) have been used by governments for decades to break up riots and political demonstrations. As early as 1989, the U.S. military blasted loud Guns N' Roses music to get Panamanian dictator Manuel Noriega to surrender (Myre 2017). Commercial container ships have used LRADs for some time to keep pirates at bay. That a Russian military officer worked on an acoustic weapon should come as no surprise. Such weapons, while in use, are very limited because they do not work well due to the laws of physics as the sound wave quickly disperses and would bounce off the outer walls of buildings. It is worth remembering that many of the attacks in Cuba were reported to have taken place inside large hotels. To target an individual inside such a structure with a beam of sound, as has been claimed, is the stuff of science fiction.

It was then claimed that unit 29155 may have been in Tbilisi, Georgia, when several Americans experienced mysterious health incidents. The problem with this claim is that people have anomalous health incidents all the time; it doesn't mean they were attacked by a secret weapon. Pelley then interviewed the unnamed forty-year-old wife of a Justice Department official who was working at the American Embassy in Tbilisi during October 2021. As she was reaching into her clothes dryer, she said she felt a loud, piercing sound in her left ear. She reported "a fullness" in her head, developed a headache, and vomited soon after. She then noticed a car parked near the gate of her home and a man nearby. When shown a photo of a man in unit 29155 who was believed to have been in the city at the time she had been "hit," she said "it absolutely does" look like him. Seconds later she grew hesitant: "I cannot absolutely say for certainty that it is this man." Then after a few more seconds, she confidently proclaims: "I can absolutely say that this looks like the man." I think it is safe to say that she is *not certain* if the man in the photo was the man she saw near her house—and even if it was, whether there's any connection to her symptoms.

The woman said that since the incident she suffers from headaches, "brain fog," and balance problems, including difficulty walking downstairs and finding the steps, especially at night. These are classic symptoms of vestibular dysfunction, which often become worse at night. The term "brain fog" is

a common description given by people suffering from anxiety. Pelley said that the woman was later hospitalized with "holes in her inner ear canals." Could this have been caused by a directed energy weapon? Perhaps, but there are known conditions that can cause such holes, including perilymphatic fistula, where fluid from the inner ear leaks causing balance problems. It can also be caused by barotrauma from a change in air or water pressure from flying or scuba diving. Other triggers are head trauma and strenuous physical exercise.

FBI Agent 'Carrie'

Pelley also interviewed an active FBI agent identified as "Carrie," who claims she was the victim of a directed energy attack. She appeared in disguise so as not to reveal her identity. She said she was in her Florida home in 2021 when she felt "a high-pitched metallic drilling noise and it knocked me forward." She then felt "pressure and pain," which began radiating from inside her right ear "down my jaw, into my neck and into my chest." She passed out on a couch and was examined by a cardiologist before returning to work. After the incident, she complained of short- and long-term memory problems. Had she been struck by a secret weapon? Maybe, but memory issues are common in people under stress—which could have been triggered by her belief that she had been attacked. Carrie said: "If I turn too fast, my gyroscope is off. … It's like I'm a step behind where I'm supposed to be, so I'll turn too fast and I will literally walk right into the wall." Her description is consistent with a vestibular event. Pelley said that Carrie was given permission from the FBI to do the interview "but wasn't allowed to discuss the cases she was on when she was hit." But Pelley said "other sources" told *60 Minutes* that one of the cases involved a mysterious white Mustang that was pulled over for speeding at 110 mph on a highway near Key West, Florida, in 2020. The driver was a young man from St. Petersburg, a former Russian military officer named Vitalii Kovalev, who had a background in electrical engineering. Carrie had apparently interviewed Kovalev in the past, and while serving his sentence for reckless driving and evading police, Carrie said she suffered two more health incidents—one in Florida and another in California. During these events, she felt a sense of disorientation and a feeling that her body was pulsating.

The 2022 Episode: A Pattern of Omission

The treatment by *60 Minutes* in March 2024 is not a one-off but part of a larger pattern of sensational reporting on this topic. In February 2022, Pelley interviewed ex-Homeland Security advisor Olivia Troye, who experienced a health event while descending a staircase near the White House in 2019 (Pelley 2022). She told him she was suddenly overcome with nausea, vertigo, and a piercing sensation on one side of her head as if "physically struck" by an external force that left her disoriented. Despite this and suffering two separate similar events that left her fearing she may have had a stroke or brain tumor, it is conspicuous that she neither reported the incidents to her superiors nor sought medical attention. The implication was that she had been the victim of an attack by a directed energy weapon. But *60 Minutes* left out an alternative diagnosis that is far more likely: a problem with her vestibular system. She said, "I felt like I couldn't really walk. … I had a depth perception issue where I couldn't figure out where the ground was. And I would start walking. And I felt like I was just gonna fall right into the ground." This description is typical of a vestibular problem that is common in the general population. According to a study in the *Archives of Internal Medicine*, 35 percent of people over forty will experience vestibular dysfunction (Agrawal et al. 2009).

Later in the episode, they talked to Robyn Garfield, an American diplomat who while posted to China in 2018 claimed that he and his family were "attacked" on multiple occasions spanning several months. He said that after returning to the United States and staying at a hotel in Philadelphia, the "attacks" continued. His evidence: one night he noticed his two children "thrashing in their beds asleep … kicking and moving pretty aggressively." He then said when he bent down to lift them up, he heard a whooshing sound like "rushing water." These events were framed as a mystery and possible attack. While it may have been the Russians using a directed energy weapon, *60 Minutes* failed to discuss far more mundane explanations. First, night terrors occur in up to 50 percent of children, are typified by thrashing during sleep, and are triggered by many factors, including anxiety (Moreno 2015). But why would his children be anxious? At the time this was reported, they had been living under the belief they were being targeted by a directed energy weapon for months! As for the mysterious rushing water sound, that too is easily explained, although *60 Minutes* failed to do so. Tinnitus occurs in up to 25 percent of adults (National Institute on Deafness 2023) and is commonly described as sounding like running water (National Institutes of Health 2022). The symptoms of vestibular dysfunction, night terrors, and tinnitus would be common knowledge to any neurologist. The failure of *60 Minutes* to offer alternative explanations—even in passing—is an example of either journalistic incompetence or deception by omission to gin up a story to create a mystery and more viewers.

The 2019 Segment

In March 2019, Scott Pelley aired yet another sensational *60 Minutes* segment claiming there was evidence that a foreign actor was zapping American diplomats with a mysterious weapon (Pelley 2019). Once again, the program was stacked with proponents of the attack theory. While Pelley noted that the FBI was investigating, he conspicuously failed to mention that the agency sent agents to Cuba and had completed their investigation the previous year. Not only did they find no evidence for an energy weapon, but they concluded that the case had a major psychogenic component (Entous 2021).

The segment also discussed a 2018 study in the *Journal of the American Medical Association*, which the program claimed found "brain injury." While the

authors of the study had been sharply criticized for an array of methodological shortcomings, there was not a peep about this in the broadcast. These flaws were well-known at the time. Prominent neurologists—such as Sergio Della Sala at the University of Edinburgh; Robert Baloh at UCLA; R. Douglas Fields at the National Institutes of Health; and Mitchell Valdes-Sosa, who heads the Cuban Center for Neuroscience—had all been critical of the study in mainstream media outlets, but no one at *60 Minutes* bothered to interview them. Dr. Della Sala had told the *Los Angeles Times* a year earlier that the standard used to detect neurological impairment—40 percent—was "unheard of in clinical practice or research" and should have been closer to 5 percent. He said that by using such a ridiculously high impairment threshold, "anybody tested—you, me … the US Embassy personnel," could be classified as impaired (Hiltzik 2018). Fields was so disturbed by the segment that he accused the producers of breaching journalistic ethics by deliberately omitting information to hype the story (Fields 2019).

A Media Litmus Test

I have followed this saga for the past seven years. If I didn't know better and all I knew of this subject was the *60 Minutes* episode, I am sure I would think, "Wow, we're being attacked by the Russians!" But I *do* know better because *I am* familiar with the literature. This is a complex case that crosses many disciplines, but the more people become familiar with the basic facts, the more it becomes evident that this is science fiction. There is nothing wrong with journalists speculating as to the origin and nature of Havana Syndrome. The problem lies in their one-sided reports and selective omission of key information. This type of ploy has become standard fare in many TV shows that attempt to prove the existence of ancient aliens, Bigfoot, and haunted houses.

While media outlets are under increasing pressure to hold onto a dwindling audience share, the best way to expand viewership is by producing a credible product that people can trust. Peddling sensationalism may result in a short-term bump in viewership, but it is not a recipe for long-term success. Based on the assessments by the intelligence community and the results of the National Institutes of Health studies, Havana Syndrome is dead. In fact, it only really existed as a social construct. The only question left to answer is: Has media integrity and balanced journalism died with it? How other media cover this story is a litmus test of our current state of media integrity—and public gullibility. ■

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[POSTCARDS FROM REALITY

ROBYN E. BLUMNER

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The Eight-Cell Person, Religion, and the Legality of In Vitro Fertilization

The case in Alabama that caused all the tumult around the legality of in vitro fertilization (IVF) was about money, of course, but also religion.

Three couples sued a fertility clinic (and the hospital in which the clinic is located) after some of their cryogenically preserved embryos were accidentally destroyed.

A patient at the hospital had gotten into the IVF unit, opened one of the sub-zero-temperature holding tanks where the embryos were stored, and took some out. Not surprisingly, the patient dropped the embryo container after getting burned by the frozen material, destroying the embryos when they hit the floor.

The couples sued the clinic and hospital under Alabama's Wrongful Death of a Minor Act, a law passed in 1872, seeking financial damages for their loss. The question for the court was whether extrauterine, eight-cell microscopic embryos were covered as unborn children under the terms of the law.

The Alabama Supreme Court ruled in February that yes, they were—thus unleashing havoc for Alabama lawmakers who had to reset the IVF applecart, which they did quickly with new legislation extending civil and criminal legal immunity to IVF clinics. Those of us on the sidelines chuckled as they struggled mightily to distinguish between embryos for IVF that get destroyed (totally fine) and those that women destroy via abortion in Alabama (totally murder).

But in addition to throwing a hypocrisy spotlight on the anti-abortion caucus, the ruling got attention for the way religion entered into the decision making. Normally jurists who impose their religion through the law do so with their inside voice.

Not so Tom Parker, Alabama's chief justice, who likened the tiny cell clusters to you and me because Jeremiah 1:5 says so!

Here's Parker's take on Alabama's "Sanctity of Unborn Life Amendment" in his IVF concurring opinion:

> The People of Alabama have declared the public policy of this State to be that unborn human life is sacred. … It is as if the People of Alabama took what was spoken of the prophet Jeremiah and applied it to every unborn person in this state: "Before I formed you in the womb I knew you, Before you were born I sanctified you." Jeremiah 1:5. … Carving out an exception for the people in this case, *small as they were*, would be unacceptable to the People of this State, who have required us to treat every human being in accordance with the fear of a holy God who made them in His image [emphasis added just for the absurdity factor].

Beyond Jeremiah, I think Justice Parker could have offered some other equally fictional references to bolster his point that size does not matter when establishing personhood. For instance, what about the evident personhood of Lilliputians from *Gulliver's Travels*? Lilliputians were less than six inches tall but had all the self-importance and other character flaws of humans, so QED, people! Thumbelina also comes to mind. She emerges from a flower, which makes her extrauterine just like frozen embryos. Or Parker could have thrown in a Dr. Seuss quote from *Horton Hears a Who!*: "A person's a person no matter how small." Perfect, don't you

think? If only ribosomes and cytoplasm could yell "We are here!"

And, if you think about it, there are some upsides to this for IVF clients, some of whom may be storing half a dozen or more fertilized eggs. I mean, that's a whole lot of dependents to claim on one's taxes. And because they can live forever and never actually grow up, they will always be minors. Alabamians found a way to avoid death *and* taxes!

Kidding aside, currently four states (Alabama, Missouri, Georgia, and Arizona) grant the unborn personhood status in law, although the law in Arizona has been blocked by court action. At least seventeen other states have brought up the issue for debate, meaning more such laws are probably coming (Hatzipanagos 2024).

These measures are a prime example of the morass that results from religion colliding with science and the law. It comes after the disastrous *Dobbs v. Jackson Women's Health Organization* ruling from the U.S. Supreme Court in 2022 that overturned *Roe v. Wade* and the constitutional right to obtain an abortion—another ruling that is, at its heart, about theology, not the science of human life. That ruling opened the door to states adopting and enforcing fetal personhood laws that make a mockery of biological science, common sense, and the law.

I guess at this point I should bring up the Catholic Church's notorious prosecution of the great astronomer Galileo for his heliocentric view of the universe. It only took 359 years for the church to apologize for that little error in judgment.

But religion has not learned its lesson. It is still imposing itself on science wherever it can, as if ignorance is a blessing from on high.

In 2025, we commemorate the 100th anniversary of the Scopes Monkey Trial, in which John Scopes was successfully prosecuted for teaching human evolution in the schools of Tennessee in violation of state law. That law specifically barred public school teachers from teaching "any theory that denies the Story of the Divine Creation of man as taught in the Bible."

Those kinds of laws were found expressly unconstitutional by the U.S. Supreme Court in 1968 in *Epperson v. Arkansas*. An Arkansas statute prohibiting the teaching of human evolution was an unconstitutional "attempt to blot out a particular theory because of its supposed conflict with the biblical account, literally read," the Court said.

It seemed game over at that point with science winning the day. Yay!

Well, not so fast. There is reason to believe that today's Supreme Court will not follow this precedent. This is the *Dobbs* Court, after all, the Court that approved coach-led prayer at public high school football games and has insisted that states must fund religious schools with tax dollars when other private schooling is being funded.

And so we are seeing renewed efforts in various state legislatures to introduce creationism-lite, or intelligent design, into science classrooms. So far, none of these bills has successfully passed. (A shout out to Azhar Majeed, CFI's director of government affairs, who lobbies against those bills wherever they arise.) But expect one to do so somewhere, sometime—teeing up the centuries-long battle of religion vs. science once again, with the stakes being the scientific literacy of our society.

When that day comes, whether a clump of eight cells qualifies as a legal person will be the least of our worries. ■

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Struggling to find the perfect gift?

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[INVESTIGATIVE FILES JOE NICKELL

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The Vanishing of 'D.B. Cooper'

Carried out on the day before Thanksgiving in 1971, the D.B. Cooper skyjacking would become the only such case in U.S. history to remain unsolved. For all its boldness and mystery, the perpetrator's real name is still unknown, as is the fate of the $200,000 in extortion money. I have continued to follow the case since I saw a special exhibit on it at the Washington State History Museum in Tacoma in 2013[1] (see Figure 1). Here is what the evidence now strongly suggests happened.

Skyjack!

The perpetrator, a white male of forty or so, was described as being between 5' 9" and 6' tall, weighing about 170 to 180 pounds, with black or brown hair and brown eyes. He wore a dark suit, clip-on tie with tie tack, overcoat, and sunglasses; carried a small black case; and used the name *Dan Cooper*. (However, a reporter mishearing a source's "D. Cooper" as "D.B. Cooper" published the latter version, which stuck.)

Cooper paid cash for a one-way ticket from Portland, Oregon, to Seattle, Washington. Then, boarding the plane (a Boeing 727-100, Northwest Orient Airlines Flight 305), along with thirty-five other passengers, he took a seat in the last row. Ordering a bourbon and 7-Up, he calmly smoked a cigarette while waiting for takeoff (Edwards 2021, 10–18).

As the plane went aloft, he handed a flight attendant a note that read, "I have a bomb. Sit by me." He gave her a glimpse of the contents of his case, revealing red sticks that resembled dynamite, with a battery and tangle of wires. Cooper gave instructions for the pilot to continue to Seattle and there, by 5:00 p.m., to pick up $200,000 in cash ($1.2 million today), plus four parachutes and a refueling truck. The pilot radioed officials at Seattle-Tacoma International Airport, who in turn contacted the airline, which authorized compliance (Gray 2012, 25, 34, 39–41; Pruitt 2018, 231–233; Edwards 2021, 14–19).

Upon arrival in Seattle, Cooper took the money and parachutes in exchange for the passengers who were let off. However, he kept the pilot and some crew members. After the plane refueled, he told the pilot to set a course for Mexico City, flying at an altitude of just 10,000 feet and a speed of no more than 200 mph. The pilot in turn told Cooper that at that speed and altitude they would need to refuel again at Reno, Nevada.

After takeoff, Cooper sent the flight attendant who was with him to join the rest of the crew in the cockpit, thus leaving him alone in the passenger area. About 8:00 p.m., the crew noticed a red light that indicated the aft stairs (a set in the tail of the Boeing 727) were being lowered. The captain inquired over the intercom: "Is everything okay back there?"; Cooper answered: "Everything is okay." This was their last communication. Minutes later, the plane made a slight dip: first the nose, then the tail. After the plane landed in Reno at 10:15 p.m., the captain waited several minutes before using the intercom again. There was no answer, and they opened the cockpit door to learn for sure that Dan Cooper had made a dramatic exit (Edwards 2021, 32–45).

Investigation

FBI special agents and forensic technicians swarmed the airplane. As part of the investigation using the code name NORJAK (for Northwest Hijacking), they immediately began conducting interviews and processing the crime scene. Two parachutes were gone, together with the briefcase and money. Recovered were eight cigarette butts (usually an excellent source of DNA from sa-

Figure 1. This military backpack parachute, left on the airplane by skyjacker "Dan Cooper," is now in the collection of the Washington State History Museum in Tacoma, where the author saw it on exhibit in 2013. (Photograph courtesy of the Washington State Historical Society.)

liva [Nickell and Fischer 1999, 201]), a black tie with tie tack, and sixty-six developed latent fingerprints. None of these would ever be matched to any of the many suspects the FBI considered (Kim 2022, 22; Pruitt 2018, 235).

The investigation focused on trying to identify Cooper (more on this presently) and on identifying his probable landing site, which was believed to be a wooded area to the east of Woodland, Washington. However, extensive searching there failed to turn up any trace of the hijacker, his parachute, or the money. He had, writers are fond of saying, "vanished into thin air" (Pruitt 2018, 235). The investigation stalled.

Then a sensational break in the case occurred in early 1980 with the discovery of $5,800 worth of tattered, crumbling bills. These were found by a young boy on the banks of the Columbia River, approximately forty miles upstream from the previously projected landing area at Woodland. The serial numbers matched those on the money intended for Cooper, the FBI having quickly microfilmed each of the 10,000 $20 bills before giving them to the hijacker.

While this remarkable discovery appeared to confirm that Cooper had indeed landed in the vicinity of Woodland, extensive searching of the Columbia River—involving scuba divers and sonar—failed to turn up more money or, indeed, additional clues of any kind (Pruitt 2018, 235–237).

Suspects

The FBI considered more than 1,000 suspects. Numerous others—real or imagined—have been posited as the actual person behind the "Dan Cooper" alias, including the following:

Richard Floyd McCoy committed a hijacking like Cooper's some months later. He then broke out of jail in 1974 but died in a shootout with agents. He was obviously not Cooper, because he was too young and did not match the physical description. He also had an alibi for Cooper's hijacking (Pruitt 2018, 238). In short, his had been a copycat skyjacking (Gray 2012, 143–147).

A few individuals have "confessed" to being the daring skyjacker. One was Floridian Duane Weber, who claimed on his deathbed in 1995 to have been Cooper. However, the FBI eliminated him because his DNA did not match that left on Cooper's tie (Gray 2012, 105–107, 251). William Gossett—a military law professor—was another self-confessed claimant, but an investigation failed to find any evidence to substantiate his claim. Still another confessee was Barbara Dayton, a transgender woman born Robert Dayton. She alleged she had committed the crime after reverting to her male identity, but the FBI apparently found no grounds for taking the claim seriously (Pruitt 2018, 239).

Then there are those who "identified" someone they are close to as being Cooper. For instance, the brother of one Kenny Christianson claimed his sibling—a former mechanic as well as a flight purser for Northwest Orient Airlines—was the elusive hijacker. However, Christianson (who had since died) failed in many respects, including not matching Cooper's description. Also, Robert Rackstraw, a Vietnam veteran who had some experience as a paratrooper, was accused in a History Channel documentary of being Cooper. Rackstraw had once been an FBI suspect but was no longer, and he completely denied the accusation (Pruitt 2018, 238, 240; Kim 2022, 22).

There was even one accused who actually bore the name *Cooper*—a deceased Oklahoman, Lynn Doyle Cooper—whose niece, Marla, made the supposed connection. But this proved to be another instance of the DNA failing to match (Pruitt 2018, 238; Kim 2022, 26–27). (In fact, the DNA was always of somewhat questionable quality, and eventually that of the cigarette butts became lost [Gray 2012, 163].)

However, a new development came in 2008, after an old military parachute was discovered within Cooper's presumed drop zone. International press coverage led the FBI to a new and unique clue: It happened that "Dan Cooper" was the name of a French-language comic book series—*Les Aventures de Dan Cooper*—that was popular in 1971! It featured a French-Canadian

Dan Cooper Comic Book cover. Credit: canoe.com / Wikipedia

airman, and one issue—in print near the date of the Northwest Orient hijacking—actually depicted him parachuting from an airplane! (See Gray 2012, 206–208, 248, 260.)

This suggests the distinct possibility that the comic was the source of the "Dan Cooper" name. As possible corroboration are aspects of Cooper's appearance given by a witness, Robert Gregory (a partner in a paint company) who sat across the plane's aisle from him. Gregory had an eye for detail, describing Cooper as "swarthy" and his hair as jet black and wavy, what he told FBI agents was "marcelled." (The *marcel wave* is an old French hairstyle, after a hairdresser of that name, Marcel Grateau [1852–1936], formed with hot curling irons. One stewardess also confirmed the wavy hair [Gray 2012, 20, 92, 240].) The suggestion is that—given the French Canadian nationality of airman Dan Cooper in the comic book—the province of Quebec might be a place to look for the skyjacker's background. (However, in July 2016, the Bureau announced it was no longer pursuing the NORJAK case so as to "focus on other

FBI artist rendering of so-called D.B. Cooper, who hijacked Northwest Orient Flight 305 out of Portland (Oregon), demanded and received ransom money upon landing in Seattle, then parachuted into the woods and was never found again. Credit: FBI.gov

NORJAK case so as to "focus on other investigative possibilities" [Pruitt 2018, 241].)

A Dark and Stormy Night …

Meanwhile, I long ago concluded that the case is effectively solved, strongly indicated by the considerable evidence, including Cooper's minimal parachuting experience, the parachutes, the severe weather conditions, and the facts gleaned from the money itself.

While FBI investigators first thought, or perhaps assumed, that Cooper was an experienced jumper—even possibly a veteran paratrooper—they soon changed their minds. A truly knowledgeable person would surely not have parachuted in such adverse conditions as those prevailing at that place and time. At 10,000 feet, his audacious jump would have taken him from his perilous position, buffeted by wind on the exposed aft stairs, into nothing less than a *thunderstorm* with air temperatures in the subzero range (minus 7 degrees Fahrenheit). Given these conditions, his attire, including his overcoat, would not have been sufficiently protective (Pruitt 2018, 237–238; Kim 2022, 4–15; Gray 2012, 99–100).

In addition, Cooper's randomly chosen ground location—which included woodlands and rocks, in addition to the Columbia River—would have yielded near-zero visibility. Everything considered, the conditions were dangerous in the extreme. Moreover, he could not have had any help waiting for him upon landing (Philbin 2012, 108–109).

Then there are the issues concerning the four parachutes he asked for: two main (rear) and two reserve (front). He should have noticed that the reserve parachute he selected was an NB6 military chute intended for use in training, and it had consequently been sewn shut. Also, his main parachute would have been difficult to steer. One expert thought it likely that Cooper would have been unable to stop tumbling and therefore failed to open the parachute (Kim 2022, 15; Pruitt 2018, 237; Gray 2012, 108–110, 205–206).

The evidence from the money is most revealing. The portion mentioned earlier as having been discovered in the Columbia River in 1980 (found in a sandbar by a boy clearing a space for a picnic fire) leads to the inference that Cooper's landing was a disaster. Some persons wishing to help the legend along suggest he may have accidentally dropped some cash as he came down. But the packets of wrapped twenties were all secured in a big canvas money bag, which he tied securely to his body with cords he cut with his pocket knife from the reserve chute (Gray 2012, 69–72, 78).

It sounds like the money would have stayed together—all or nothing. In any event, if only some was accidentally dropped, then what happened to the rest? Not a single one of the remaining bills has ever been found (Pruitt 2018, 241). In theorizing, we should remember the scientist's rule of thumb called Occam's razor, that is, to prefer the explanation with the fewest assumptions as most likely to be correct.

All things considered, the preponderance of evidence strongly supports the theory that the skyjacker of 1971, calling himself "Dan Cooper," perished in carrying out his bold crime. Why were his remains never found? Searchers were faced with a possible area of some 800 square miles—in which a human body would be the proverbial needle in that vast haystack (Kim 2022, 16). Moreover, his body would have been damaged by impact, predatory animals, decomposition, and now decades of weathering. Even in a small area, such remains would have been difficult to find in 1971 and would be especially unlikely today.

With the irony of being one of America's best-known outlaws, while at the same time being actually one of the least-known—completely unidentified for over half a century—Cooper is the subject of yet greater ironies: his crime was both a great success and an even greater failure; as well, it was one of the most difficult to solve, in terms of the skyjacker's identity, but one of the easiest overall. ■

Note

1. The Washington State History Museum's Cooper exhibit ran from August 2013 through January 5, 2014. In addition to one of the four parachutes provided by the airlines (Figure 1), the exhibit featured some of the $20 bills discovered in the Columbia River in 1980, FBI documents, and a mock-up of a 727 interior, together with an actual rear airstair (Poyner and Whiting 2013, 9).

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[THE PHILOSOPHER'S CORNER MASSIMO PIGLIUCCI

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Pseudoscience: Do We Know What We Are Talking About?

If I had to guess, I'd bet that readers of Skeptical Inquirer feel fairly confident that they can identify notions that count as pseudoscientific and distinguish them from notions that don't fall into that category. Homeopathy? Yes. Chemistry? No. Astrology? Yes. Physics? No. UFOlogy? Yes. Biology? No. And so forth.

We may disagree on some of the likely borderline cases. For instance, is SETI, the Search for Extraterrestrial Intelligence, a pseudoscience? I'd say no, but I would understand why someone might have doubts. What about parapsychology? I'd say yes, it is a pseudoscience, but, again, there may be room for disagreement.

This general scenario seems also to be the consensus among those few philosophers who specialize on the so-called demarcation problem: the difference between science and pseudoscience. In a book chapter coauthored with my friend and colleague Maarten Boudry, for instance, I wrote, "Philosophers and scientists readily recognize a pseudoscience when they see one" (Pigliucci and Boudry 2013).

Or take Sven Hansson, another philosopher who has written on the topic:

> There is widespread agreement that creationism, astrology, homeopathy, Kirlian photography, dowsing, UFOlogy, ancient astronaut theory, Holocaust denialism, and Velikovskian catastrophism are pseudosciences. In spite of a few points of controversy, for instance concerning the status of Freudian psychoanalysis … the general picture is one of consensus rather than controversy in particular issues of demarcation. (Hansson 2021)

We may not have found a sharp divide between science and pseudoscience—likely because there isn't one—but as U.S. Supreme Court Justice Potter Stewart famously said about pornography, "I know it when I see it."

Or maybe not. A paper authored by Kåre Letrud of Inland Norway University of Applied Sciences argued based on empirical evidence that maybe we don't know what we are talking about when it comes to pseudoscience (Letrud 2023). At least in part.

Letrud did something increasingly common among philosophers, especially those interested in science: he collected data on the issue. He looked at several papers on the topic of pseudoscience and marked every time that a particular concept, area of inquiry, or term was labeled as *pseudoscientific* or incompatible with pseudoscience (i.e., labeled as science, explicitly not pseudoscience, or other).

The results were very clear and, at least on the surface, a bit surprising. Only a minority of the cases that made it into his database pointed to a clear consensus among different authors that something counted as an example of pseudoscience. In most cases, there was no consensus.

The consensus cases were not unexpected: astrology, creationism, homeopathy, intelligent design, parapsychology, and UFOs. The situation was less clear for alternative medicine, ancient astronauts, climate change denialism, and several others. And there was almost no apparent consensus for a long list, including animal magnetism, the anthropic principle, anti-gravitational devices, the Bermuda Triangle, Feng Shui,

cell phone radiation, and on and on.

This is more than a bit surprising. If you go through the list presented by Letrud as a multi-page bar graph and available as a spreadsheet in the supplementary materials accompanying the paper, you might be surprised at so many (to me!) obvious examples of pseudoscience, including several of those I just listed, that didn't make the cut.

I mean, maybe we can discuss whether the anthropic principle qualifies as pseudoscience or is simply bad science (or, more appropriately, bad philosophy). But the Bermuda Triangle? I think the problem is in the details, as is often the case when surprising results emerge from empirically based research.

To begin with, Letrud tells us at the beginning of his method section that "A full review of 'pseudoscience' and 'pseudoscientific' usage in the scientific literature would be a vast and daunting task and it would presumably also have to navigate frequent polemic usage. Instead, I have chosen to review the philosophical literature; this is where one would expect to find deliberated assessments of potential pseudosciences."

But arguably *neither* the philosophical *nor* the scientific literature are good places to look for the kind of data relevant to the problem Letrud is investigating. This is because most scientists and philosophers simply do not write about pseudoscience. At all. Sure enough, Letrud's combing of the PhilPapers archive of 2.5 million titles yielded only 149 papers that could be used for his investigation. That's a fraction of 0.00006 and pretty close to insignificant. The best source of serious writing on pseudoscience, I suggest, are the few magazines dedicated to the topic and published by organizations that are focused on the phenomenon, such as Skeptical Inquirer. Skeptics are the professionals, in this case, not scientists or philosophers, except for those very few philosophers of science who work specifically on pseudoscience, such as yours truly.

If we move from methods to results, we find that Letrud summarized his findings in the following fashion:

> The Appendix shows 511 potential pseudoscience cases that were discussed, referred to, or categorized by at least one of the 149 documents. Of the 511 cases, 192 were not classified by these documents as pseudosciences. Of the 319 cases classified as pseudoscience, 193 (approximately 60%) were classified by single documents and showed therefore no agreement between two or more documents. Of the 126 cases that were each classified as pseudoscience by at least two documents, 124 were classified as a pseudoscience by a simple majority. Sixty-two out of 319 pseudoscience cases (19%) were classified as pseudoscience by more than 3 documents (2%).

I think you can spot the problem here. A whopping 60 percent of the entries in the spreadsheet were classified (as pseudoscience, science, not-pseudoscience, or other) in *only one single* paper. Of course, those instances could not show any agreement with other papers, because those entries were unique. Many of the other cases included situations in which the term to be classified was mentioned in only two papers. The lack of consensus on most entries, therefore, is an artifact resulting from many of the corresponding concepts being mentioned very rarely in the literature surveyed by Letrud. It's not that people don't agree that, say, feng shui is a pseudoscience. It's that very few of the (very small) group of philosophers interested in pseudoscience mentions feng shui at all!

I went to the supplementary materials and downloaded the spreadsheet made available by Letrud, which confirms that the data are very, very sparse. This is to be expected, because the papers in question are not catalogs of pseudoscience but conceptual discussions of the demarcation problem and surrounding topics.

Just to give you an example, one of the papers that made it into Letrud's database was published in 1980 by R.P. Thompson in the *Proceedings of the Biennial Meeting of the Philosophy of Science Association*. The title is "Is Sociobiology a Pseudoscience?" It mentions only two examples of pseudoscience: astrology and biorhythms. It also mentions one example of a field the author considers a science: sociobiology. That's it! We are simply given *no* information about what Thompson thought about all the other entries in the table (a total of 511), which cannot be taken as evidence that he doesn't think, say, that homeopathy is pseudoscience. This is truly a case where absence of evidence is not evidence of absence.

Alternatively, consider one of the examined concepts: the Bermuda Triangle. In the 149 papers, it is mentioned exactly four times: two as pseudoscience, one as not science, and one as undetermined (if I understand the legend of the table provided). One of the pseudoscience labels comes from a paper published in *Minerva*, a journal covering the sociological study of scientific knowledge and research, the other from a chapter in the collection on pseudoscience edited by Boudry and me. The non-pseudoscience classification originates from a paper published in *Science & Education*. And the undetermined label is from a book titled *The Logic and Methodology of Science and Pseudoscience*. The notion of the Bermuda Triangle appears *nowhere else* in the database. One simply cannot tell, on the basis of these scant data, whether there is a consensus about the Bermuda Triangle or not. I bet, however—and admittedly this is only intuition on my part—that most skeptics will readily agree that this is indeed an example of pseudoscience.

The above notwithstanding, I think Letrud is right in advising, near the end of his paper, that for the purpose of testing candidate criteria for demarcating science from pseudoscience it may be best to focus our attention on the clear cases: homeopathy and astrology over here, physics and biology over there. The problem is that the most interesting stuff to be learned lies in between the two. SETI, anyone? ■

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[BEHAVIOR & BELIEF STUART VYSE

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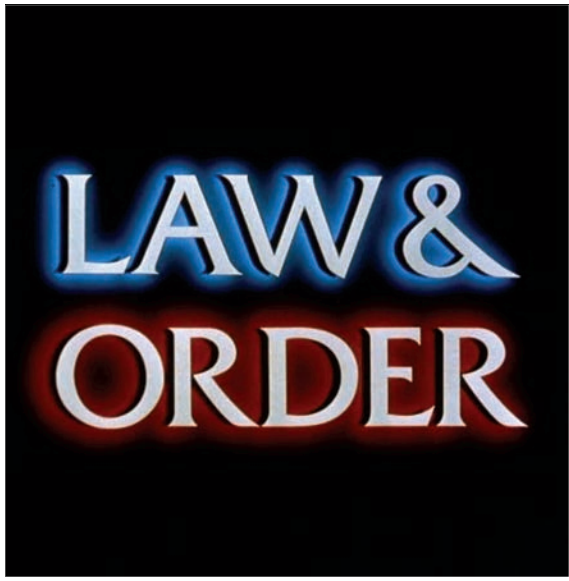
Savoring Uncertainty: A Skeptic Goes to the Movies



Editor's note: Spoiler alert! This column contains information that might spoil the ending of the movie Anatomy of a Fall. *However, what actually constitutes a spoiler is not always clear, a topic discussed in the column. Some evidence even shows that spoilers might increase the enjoyment of a movie, a topic discussed at the end of the column. Thus, in a way, this editor's note is a spoiler for the ending of this column. I hope it enhances your enjoyment.*

The Palm D'Or– and Academy Award–winning film *Anatomy of a Fall*[1] was one of my favorites of 2023, and the opening credits gave a hint of what was ahead when the website address didshedoit.com flashed on the screen. In the story that followed, the central character, Sandra, was accused of the murder of her husband, Samuel, who died in a fall from an attic window of their chalet near Grenoble, France. As the investigation and trial progress, Sandra, played by the Oscar-nominated Sandra Hüller, insists that she is innocent, but the viewer comes away profoundly uncertain of the truth. Knowing that the audience would have different opinions, the filmmakers provided a website where people could vote yes or no on the question "Did she do it?" and provide arguments in favor of their judgments.

I loved the film. On the one hand, it's a fairly standard courtroom drama. The peculiarities of the French legal system look unusual to U.S. viewers, but, despite a few surprising turns in the trial, the story progresses like a conventional *Perry Mason* or *Law and Order* plot—except that the viewer is denied the certainty of knowing what happened. In less skillful hands, this kind of ending might be considered an unsatisfactory ploy, but based on the many accolades the movie has received, the filmmakers succeeded in getting their audiences to not just tolerate the uncertainty of the ending but to thrill in it. I suspect there would have been far less buzz had a clear answer been supplied.

Belief in a Just World

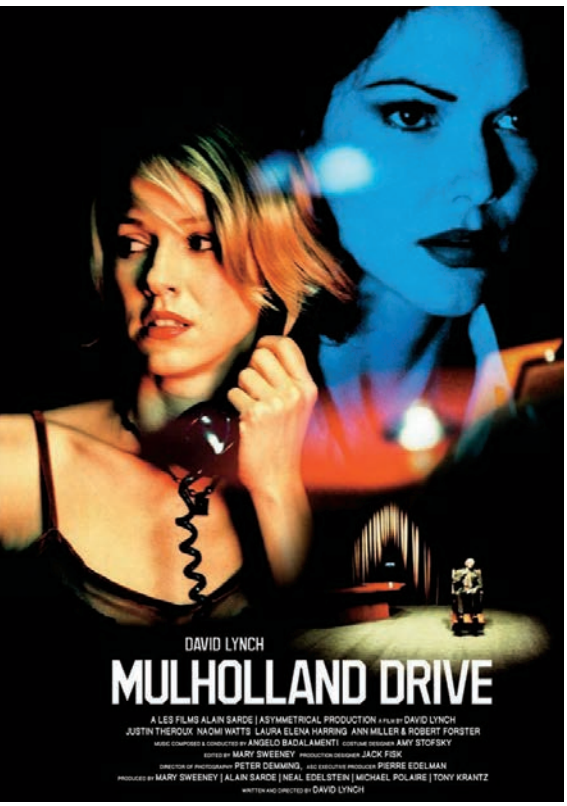
Unlike *Anatomy*, many of the most lucrative films of all time feature superheroes and supervillains battling to a clear resolution. Characters who started in the painted panels of comic books have become the CGI giants of melodramatic movie epics. Similarly, some of the most successful television dramas provide narrative arcs that come to satisfying conclusions within a single hour. The *Law & Order* franchise ran for twenty-three seasons and has only been surpassed in longevity by its spin-off *Law & Order: Special Victims Unit*, currently in its twenty-fourth year.

Given the chaos of everyday life, it's understandable that people are drawn to stories that make sense and provide closure. In addition, these self-contained plots may reinforce many viewers' beliefs that the world is just. Since the 1970s, psychologists have studied people's varying levels of endorsement of the *just world hypothesis* (Lerner 1980). Researchers have found that belief in

a just world is correlated with several other attitudes (Dalbert 2009), including victim-blaming, which can be applied to either other people ("he must deserve it") or oneself ("I got what I was due"). In general, people who believe the world is just are happier than those who don't, and recent research suggests that the commonly observed relationship between religiosity and well-being may be caused by religious constructions of a just world (Schuurmans-Stekhoven 2021). There is evidence that—rather than directly affecting well-being—religious and spiritual beliefs promote the assumption that the universe is fair, which in turn leads to greater happiness. According to this view, when religious people endure random hardships, they find solace in the belief that they will be made whole later in this life or the next.

Critical Thinking and Film

We all need the comfort of a simple pat ending now and again, but the world doesn't work that way. The psychologists who study just world belief have long described it as a delusion—or more generously as a "positive illusion" (Lerner 1980; Taylor and Brown 1994).



Science tells us the universe does not keep score, and the Earth does not spin on a moral axis. The real world is far more like *Anatomy of a Fall* than *Law & Order*.

The characteristics that facilitate critical thinking—curiosity, a willingness to tackle difficult material, and tolerance of ambiguity—stand in opposition to a faith-based belief that the world is fair. Eventually, science pulls some order out of the apparent chaos we experience, but it requires us to endure a healthy dose of confusion on the way to the truth.

For people who are drawn to ambiguous plots and complex characters, many excellent films will test your critical thinking skills. For example, David Lynch's 2001 *Mulholland Drive* has a confusing nonlinear plot that some viewers believe is merely designed to create an art-house atmosphere, while others believe it is a puzzle with a coherent solution (Willemsen and Kiss 2019). Both interpretations likely contribute to the film's enduring appeal. *Mulholland Drive* was rated #8 on the 2022 *Sight & Sound* list of the greatest films of all time (British Film Institute 2022). For those so inclined, there are many films that will challenge your critical thinking skills: *Pulp Fiction* (1994) *The Matrix* (1999), *The Sixth Sense* (2000), *Memento* (2000), *Eternal Sunshine of the Spotless Mind* (2004), and *Inception* (2010) to name just a few. These are sometimes called "puzzle films," and they have become increasingly popular since the mid-1990s (Poulaki 2014).

Social scientists look for answers to all kinds of questions and, as it turns out, one of them is "Who is drawn to complex movies?" Steven Willemsen and colleagues (2022) created a questionnaire to measure "preference for complex narrative" and surveyed 114 North American and Western European adults between the ages of twenty-two and sixty. To determine what personality dimensions were correlated with a preference for complicated stories, the researchers also asked the participants to fill out several personality questionnaires. People with a greater preference for complex narratives were also significantly higher on *tolerance for ambiguity*, *need for cognition* (i.e., enjoyment of cognitively effortful tasks), and *openness to experience*. These are precisely the characteristics you would want in a critical thinker or scientist.

Film Noir

For those drawn to ambiguity in film, the film noir movement of the 1940s and 1950s provides plenty of examples. These black-and-white post–World War II classics often featured brooding male leads, shadowy sets, moral ambiguity, and unhappy or unresolved endings (Borde and Chaumeton [1955] 1996). The classic noirs include *The Maltese Falcon* (1941), *Double Indemnity* (1944), *Laura* (1946), *Key Largo* (1948), *Strangers on a Train* (1951), and *A Touch of Evil* (1958), but my personal favorite is Nicholas Ray's *In a Lonely Place* (1950), starring Gloria Grahame and Humphrey Bogart. Bogart plays Dix, a hot-tempered Hollywood scriptwriter who falls in love with Laurel, a somewhat mysterious aspiring actress played by Grahame. Dix is suspected of murdering a young woman, and questions about his guilt or innocence create the major tension of the film. By the end, no one comes away unscathed. The story does not come to a happy ending, but neither is there a discernible lesson to be learned—which, of course, is true of life, too. The universe has no interest in your success or failure, and things don't happen for a reason—they just happen. Film noir is a good reminder.

Dreary old black-and-white films are not for everyone, but film noir movies may be good training for critical thinkers and those with a scientific worldview.

Do Spoilers Spoil?

Because people seem to value closure and the tying up of loose ends, spoilers have become a serious taboo. Most reviewers of books, movies, and television programs go to great lengths to describe the work without giving away the ending or any important plot points, and it appears that the creators of these art forms often support these efforts. In 2019, the promotional campaign for the

Gloria Grahame and Humphrey Bogart in a still from Nicholas Ray's 1950 film noir classic *In a Lonely Place*.

movie *Avengers: Endgame* included the following admonition: "When you see *Endgame* in the coming weeks, please don't spoil it for others, the same way you wouldn't want it spoiled for you" (Ryoo et al. 2021, 70). Similar requests have been made since at least 1952, when audiences for the Agatha Christie play *The Mousetrap* were asked not to reveal the ending (Greene 2019). In a 2005 article, movie reviewer Roger Ebert admonished his fellow reviewers for revealing important features of the story without providing a "spoiler alert!" warning (Ebert 2005). For any conventional story, many people prefer to experience firsthand the surprise of plot twists and maintain the uncertainty of how the tale will end.

But what constitutes a spoiler is not easy to define and varies depending on the context. For example, in my description of *Anatomy of a Fall*, I gave you what is arguably the most important feature of the film—it is impossible to determine the protagonist's guilt or innocence—but by omitting some important plot points and the resolution of the story, I managed not to spoil the movie (at least, I hope not). But not everyone would let me off that easily. In a book called *Spoiler Alert! (It's a Book about the Philosophy of Spoilers),* philosopher Richard Greene delves far more deeply into the subject than anyone I have ever come across. After examining many different ways a story could be spoiled, he arrives at this rather elaborate definition of a spoiler: "Any information about a work of fiction (distinct from that work of fiction itself), including plays, novels, television programs, movies, etc., that has the potential to reveal some significant (or shocking) information that is neither common knowledge nor sufficiently old (as determined by context) to someone who has not yet encountered that information" (Greene 2019).

So according to Greene, I may have spoiled *Anatomy of a Fall*; however, in my defense, both the trailer for the film and the word of mouth about it conveyed that the guilt or innocence of the main character remains in question. So, I'm hoping my own innocence hangs on the "common knowledge" clause of Greene's definition.

Greene points to some interesting spoiling situations. First, in the case of sporting events, the mere news of who won is the single biggest spoiler. I rarely watch recordings of games or matches I've missed, but I have almost no motivation to watch if I already know who won. Greene tells an amusing anecdote of his attempts to not learn the result of an important playoff game that he was recording at home because it was being played while he was on an airplane. He avoided looking at any media and wore headphones on the plane to avoid talking to other people and distract himself—only to have the pilot break into the sound system to report the score. The news came through the headphones he was wearing to keep the information out. Mysteries such as *The Mousetrap* are similar to sporting events in that figuring out "who done it" is a large part of the fun, and revealing the culprit would be a serious *faux pas*.

According to Greene, the age of the work and the age of the person receiving the information matter. For example, he argues that going to an elementary school playground and shouting "Darth Vader is Luke Skywalker's father!" would qualify as a spoiler because the kids would be too young to be expected to have either seen *The Empire Strikes Back* or chosen not to see it. But because the film came out in 1980, the same information would not be considered a spoiler in most other settings. However, in the weeks following the release of *The Empire Strikes Back*, revealing this famous plot twist would be a huge spoiler regardless of the person's age.

Many drama films are quite different from sporting events and mysteries with respect to spoiling. I recently saw *One Life* (2023) starring Anthony Hopkins. In my opinion, the trailer—which I had seen several times—spoils the entire movie, yet I thoroughly enjoyed the film and, as I expected, cried several times. Similarly, there are movies and books we go back to view or read over and over despite knowing the story very well. I have watched the original *Jaws* once a summer for at least the past decade, and I don't think my enjoyment has

decreased with repetition. Some stories appear to be spoiler proof.

Which brings us to the scientific question: Do spoilers really spoil our enjoyment? Jonathan Leavitt and Nicholas Christenfeld created quite a buzz when they published two studies that seemed to show that, contrary to common belief, spoilers *enhance* enjoyment rather than diminishing it (Leavitt and Christenfeld 2011; 2013). However, their results may have been peculiar to their methods and the situation they studied. In both studies, Leavitt and Christenfeld had students read written stories, some of which had introductory paragraphs that spoiled the ending and some that did not. The results showed a small but statistically significant preference for the spoiled version. Leavitt and Christenfeld suggested that, with the major uncertainties removed in the spoiled stories, their college students were free to become more engaged and take greater appreciation of the steps along the way to the conclusion. But wait! That's not the end of the story.

As is often the case in science, subsequent research has complicated the picture. In 2015, two researchers attempted to replicate Leavitt and Christenfeld's findings using more sophisticated measures of preference and enjoyment and found either no spoiler effect at all or that spoiling *lowered* enjoyment, consistent with the conventional view (Johnson and Rosenbaum 2015). Finally, a group of Canadian and American marketing researchers posed the more practical question: Do spoilers affect a film's box office numbers (Ryoo et al. 2021)? They looked at the first eight weeks of revenue for 993 movies released in the United States between 2013 and 2017 and compared those figures to the degree of spoilers found for those films in the user reviews on the Internet Movie Database (IMDb).[2] Using a sophisticated statistical analysis, they found that, when more information was given away in reviews, the film had higher revenues. The researchers suggested that underlying this relationship was the benefit of "uncertainty reduction." Consumers want to have a better sense of what is going to happen in the film before shelling out $16 to see it. If this interpretation is correct, once again, the basic human desire for certainty and closure was at play.

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This does not represent a very large body of research on spoilers, but it's clear that both the basic concept of a spoiler and the potential effects that spoilers can have are more complicated than we might expect. But skeptics are not afraid of complicated things or unsolved puzzles. That's the nature of life.

So, I leave you with a final suggestion. Now and again, go watch a movie such as *Anatomy of a Fall* or *Mulholland Drive* that defies your efforts to pin it down and revel in the possibility of multiple hypotheses both known and unknown. You can always go back to stories that click shut like a jewelry box. There is no shortage of them. But if you can find pleasure in a story that doesn't come to a happy ending or any clear ending at all, then you may gain a greater appreciation for the world as it is and the challenge to understand it. ■

Notes

1. *Anatomy of a Fall* won the Palm D'Or at the 2023 Cannes Film Festival and was nominated for five Academy Awards, including Best Picture, Best Actress (Sandra Hüller), and Best Director (Justine Triet). Triet and Arthur Harari won for Best Original Screenplay.

2. IMDb asks users not to include spoilers, but evidently not everyone complies.

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[THE PRACTICAL SKEPTIC MICK WEST

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Avoiding Conflict Avoidance

A few weeks ago, I was a guest on a UFO podcast. The host, Jay, was an "experiencer": someone who believes they have had some kind of close encounter with UFOs or nonhuman entities. In Jay's case, he'd seen some unexplained lights moving in strange ways over his house after a period of meditation.

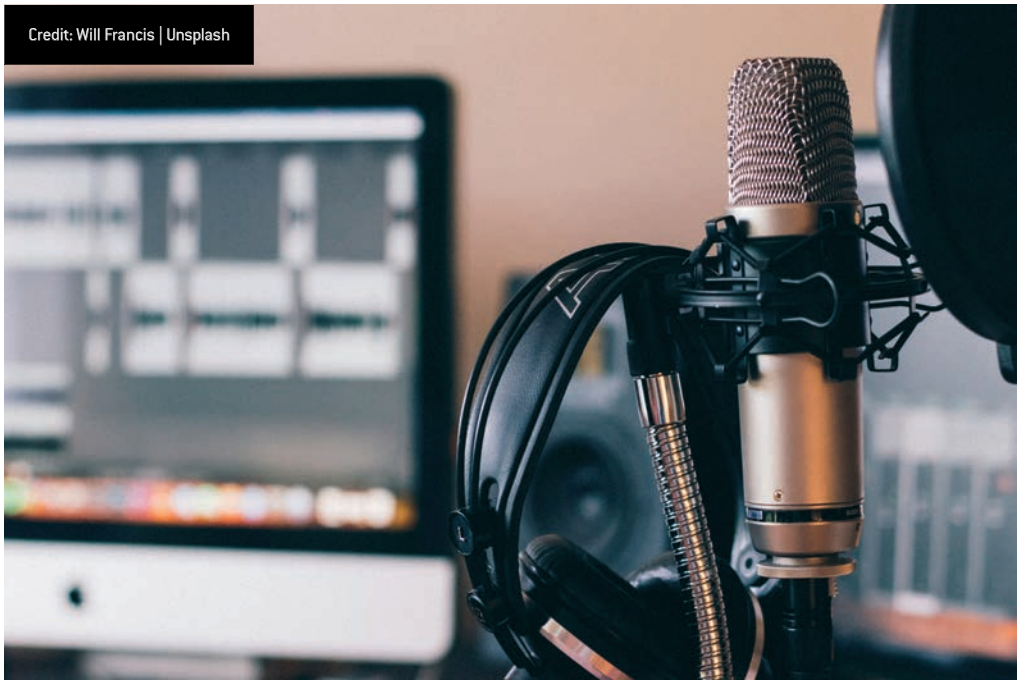
I'm a practical skeptic, so I offered a few thoughts on the matter. Ultimately, though, we both agreed that it was a difficult thing to resolve. We only had Jay's recollection, and I was not there, so there was not a lot of evidence to analyze.

That was just a part of a wide-ranging discussion. We talked about my history with UFO investigations, discussed the current goings-on in the UFO community, and even delved into topics such as artificial intelligence and mind-body duality. Overall, it was an enjoyable and mutually respectful discussion.

The podcast was on video, and it was premiered on YouTube a few days after it was recorded (Anderson 2024). A YouTube premier is sort of like a live video; it starts at a specific time, and there's a chat window where viewers can type comments, just as if it were live. I wasn't doing much, so I hopped on to participate in the chat.

It was a tough crowd. Initially, they did not know I was there, and there were comments such as, "this guy is a proven liar," "why is Jay giving this shill a platform?," and "he needs to drop some DMT" (referencing a hallucinogenic drug).

I was somewhat disheartened. I'd enjoyed our conversation at the time, and it seemed like Jay had, too. I was even enjoying relistening to it. But his audience seemed unanimously annoyed that we were even talking and considered me the enemy.



Credit: Will Francis | Unsplash

I chimed in a couple times and got some more quips in the same vein thrown my way. I was tempted to engage in more depth, but thankfully I decided to just watch the interview and read the comments without distracting people.

The podcast premier ended after about ninety minutes. Somewhat surprisingly, the tone immediately changed in the chat. There were still people criticizing me, but then others started to chime in with positive comments such as "great show, Jay!," "very interesting," and even "Mick is great."

Politeness

I realized that this sudden change was in part due to there being not one but two audiences; one was highly reactive, already convinced that I was a "lying shill" who was there mostly to share their opposing thoughts in the chat.

The other audience just watched the whole interview, probably ignoring the chat. They were mostly people who disagreed with my overall assessment of the case for UFOs being nonhuman craft, but they still listened to what I had to say. It gave them some food for thought.

All this made me reflect on a topic that I've been thinking about for nearly twenty years: the role of politeness and avoiding conflict in contentious discussions.

When I first started writing about esoteric topics back in the early 2000s, I wasn't particularly polite. I thought that all you had to do was lay out the science. I quickly found that being insensitive would invariably lead to conflict, and conflict was the death of constructive discourse.

So when I started my Metabunk forum in 2010, I laid out a set of rules based on the rules found at the Bad Astronomy Forum (Plait 2005). It did this in part because I'd just seen Phil Plait's "Don't Be a Dick" talk at The Amazing Meeting earlier in 2010 (Plait 2010).

In that talk, Plait eloquently made the case that our demeanor can have a great influence on the effectiveness of our communications with "believers." This very much resonated with my experience up to that point, and so I instituted a quite draconian politeness policy on Metabunk, insisting that everyone treat people politely and with respect no matter how ridiculous (or even insane) you thought their theories were.

Sources of Conflict

But like all things in life, there are nuances and complications. Being polite in a conversation is a great way of avoiding conflict. But is it possible to take it to extremes?

What creates conflict? In the topics I tend to discuss (conspiracy theories, pseudoscience, and especially UFOs), conflict arises when someone takes criticism personally.

This can be direct or indirect. Directly, it's when you say something that comes across as being a negative judgement of that person. For example, with UFOs, if you suggest that a person might have been hallucinating when they saw a football field–sized craft over their house, then they might interpret that as you saying they are mentally ill, lying, or stupid.

Indirectly, people often base their beliefs on the testimony or opinion of experts whom they respect. These experts could be scientists, doctors, or domain experts such as military pilots. When you suggest that it's possible that those experts might have made a mistake (or especially if you attempt to show that they *have* made a mistake), then this can come across as a baseless attack on the person. This is especially true if you lack any credentials that the expert might have. You will be perceived as being deeply insulting to the expert, and then the conversation devolves into conflict and arguments about how you can be so impolite.

Conflict Avoidance

So, to prevent these types of derailments, I've tried to avoid triggering them. The problem here is that any discussion that involves a disagreement is essentially a conflict. If we focus on conflict avoidance, then we can't make any progress. We're not really having a productive discussion; we're just chatting.

In psychology and business, excessive conflict avoidance is often considered a negative. Psychologically, avoiding conflict can lead to bottling up your true feelings and a lack of genuine communication with family members. In business, conflict avoidance can lead to very real problems never being addressed because one party avoids bringing them up out of fear of insulting the other party.

It's a bit of a paradox. Conflicts can derail a conversation, but avoiding conflicts can mean the conversation never gets anywhere. How do we resolve this?

Part of the answer is to recognize where the conflict is coming from. If you are following the "Don't Be a Dick" mantra properly, then you are certainly not *trying* to upset anyone. Instead, the conflict arises from the reactions of your interlocutor. You are not creating conflict, but you are saying things that get interpreted as rudeness and aggression.

So, what should we do? It's complicated. We want conflict in the sense that we want constructive discussion about our differences of opinion. We also want to be able to share information that might conflict with their deeply held beliefs. What we want to avoid is the *perception* that this conflict is some overtly bad-faith act on your part.

It's Not You, It's Them

People with fringe beliefs usually know that their beliefs are fringe. They also "know" those beliefs are correct. This often makes them highly reactive to perceptions of criticism.

Within their own communities, especially the more esoteric ones, this often manifests as conflict avoidance in discussions between advocates. Conflict avoidance in the UFO community results in an environment where all experiences are treated as genuine encounters with something amazing. Someone

tells a story about a glowing light following them from behind some trees, and the community will respond with similar tales and speculation about what type of exotic technology or trans-dimensional being might be responsible. They very rarely raise mundane explanations, such as it was the planet Venus.

As skeptics, we must recognize that we are dealing with communities that value their beliefs as much as they would religious faith. The communities are insular, with support groups and safe spaces that reinforce deeply held beliefs, and simply avoid discussing anything that creates conflict.

Somewhat paradoxically, it's this avoidance of conflict on the part of the believers that ends up creating conflict. A lack of exposure to alternative (i.e., mainstream) theories, along with a default expectation of acceptance fostered by an insular community, tends to make people highly reactive to perceived criticism.

The Practical Outcome

From a practical skeptic's perspective, this makes communication difficult. In the chat section of the UFO podcast, many participants judged me as an enemy before the episode began. The aggressive conflict had already started, and anything I might say to those people would likely only make it worse. Whenever I offered a hypothesis they did not like, it was immediately scorned and rejected.

But then, the discussion was actually a very good one. While Jay and I did not agree on anything, we were both respectful. Jay would later go on to defend me on Twitter and even criticized the more aggressive segments of his audience.

They were not all aggressive. If you look at the chat and the comment section of the video, you'll see most of the comments are negative. But then there's a significant number that were the opposite—people who found the conversation constructive and interesting even if they disagreed with a lot of what I had to say.

Then there were the silent listeners. Most people do not comment; they don't engage with you online. They simply listen (or read). Out of the 5,000 people who watched the video in the first few days, only 5 percent left a comment, and less than half that number participated in the live chat.

We don't know how that silent majority reacted to our conversation, but my inbox is full of older messages from people telling me that they originally thought I was a shill, but eventually they listened to what I said, and over a long period of time, often months or years, their opinions were changed toward science.

The bottom line is a mixed one. We want to avoid conflict, but we also want to present missing information and share concerns and hypotheses that are naturally at odds with the bedrock of the communities we engage with. Those communities are overly sensitized to the perception of conflict arising from criticism because they avoid it internally.

Pick your battles and tread lightly. Engaging with individuals in the chat or even the comment section would have been a waste of time. But by politely engaging with the host, I could still communicate with a segment of his audience. I engaged Jay respectfully while challenging his ideas. His audience saw this lack of acrimony, and so their initial jump into conflict was avoided.

Finally, don't take it personally. Most of the people you meet are well-meaning, just with a different set of ideas and beliefs. The mainstream scientific rejection of these ideas has pushed them into a defensive position. Their anger is misplaced, but it is understandable. To reach them, you need to put your personal feelings aside and try to understand where they are coming from and how an aversion to intellectual conflict can lead to verbal conflict. Then figure out how to, politely, work around it. ■

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Mystery of the Silent Shooting

Q: **I saw a video going around saying that a nightclub shooting was faked—a false flag operation. I'm not a conspiracy theorist, but I looked at the video and it does seem strange. Is there anything to this?**

—Chad B.

A: The question above was accompanied by a tragic news story: On November 7, 2018, a shooting at the Borderline Bar and Grill in Thousand Oaks, California, by former Marine Ian David Long left nearly a dozen people dead, including the shooter. One victim, Sgt. Ron Helus, was killed not by Long but instead by friendly fire from another police officer's gun in the chaos. Dozens more were injured, mostly while escaping the club.

I watched on Instagram the one-minute video offered, posted (and presumably taken) by Dallas Knapp from inside the club. Loud gunfire can be clearly heard, as can breaking glass and some indistinct sounds. The video is dark and unclear; I had initially thought it was taken outside the club. It shows a chaotic scene and a dark, empty dance floor. A man is seen in the background, but it's not clear if it's the shooter, a victim, or a police officer (see Figure 1). The cameraman turns and runs, exiting the building moments later.

Tale of the Tape

As Chicago's ABC 7 News described:

> The video shows what appears to be a semi-empty dance floor as a man dressed in dark clothing is behind a counter-like wall and shooting. About 10 gunshots are heard in the video. The man taking the video runs out of the venue and yells, 'Guys, run, he's coming out this door!' Several people are heard screaming in the distance. ("Dramatic Video Captures" 2018)

Myriad conspiracy theorists watched the video and suggested that the shoot-

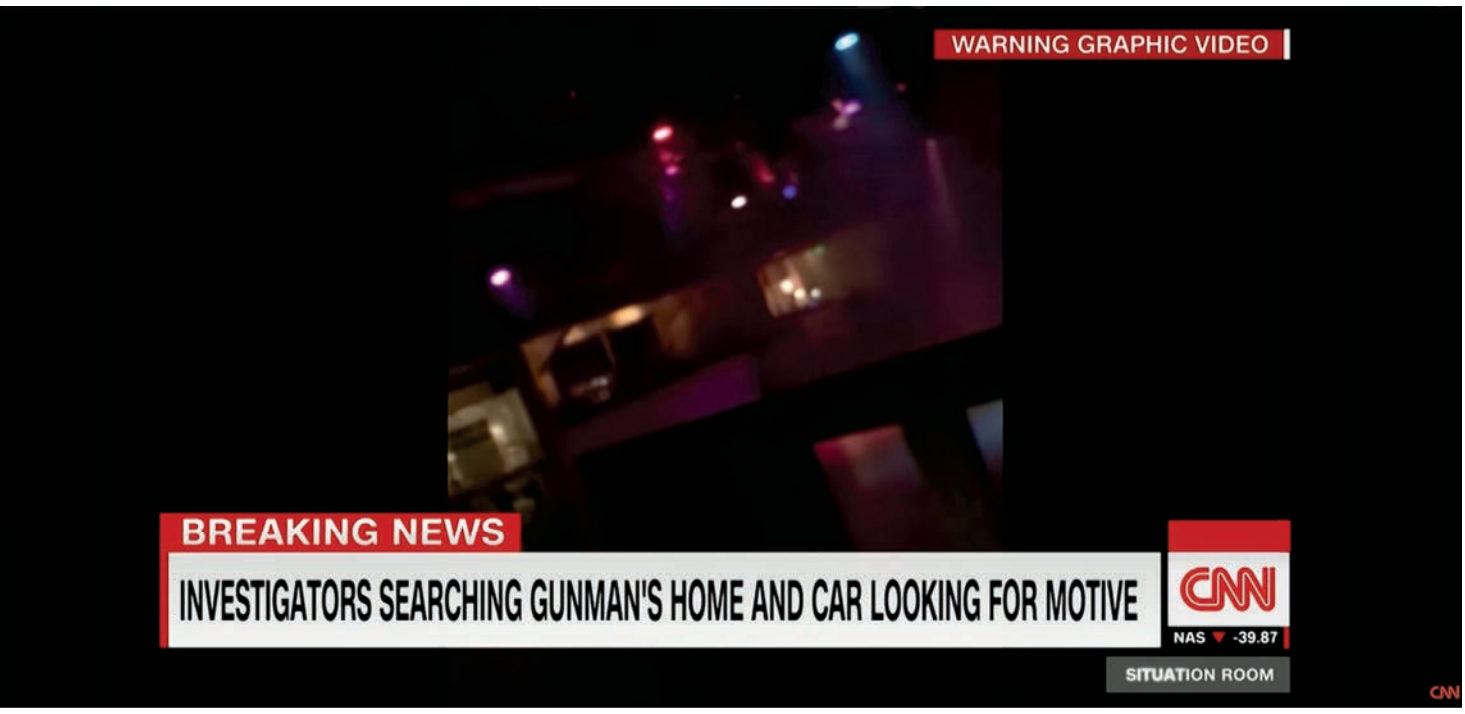

Figure 1. Screenshot of CNN coverage featuring video taken inside a nightclub during a 2018 shooting, which spawned conspiracy theories.

5 years ago
An empty bar, no blood on the floor, no dead bodies on the floor, no chairs knocked over, no drinks sitting at the bar, no smashed glasses or bottles on the floor, no liquid from drinks being spilled on the floor, no music playing, no one running around trying to get out, no one hiding, no one curled up into the fetal position crying and unable to move.
If you comment to me that the shooting was almost over and almost everyone ran out already, then explain why was there one person sitting at the bar, by themselves in the "I'm bored ..
Read more
108
Reply
8 replies
5 years ago
Video showed nothing ???? Good job CNN....
109
Reply
3 replies
5 years ago
You seen NOTHING in that video apart from an empty dark building, the sound of a blank gun and a window smashing, then some shaky can running.
Oscar nomination for cheeiest fake story.
12
Reply
5 years ago
Graphic?????? The place was empty!! No people, No blood!! WTF! HOW CAN YOU SAY GRAPHIC VIDEO???
187
Reply
22 replies
5 years ago
The video and CNN's description of events don't match. Somethings up...
130
Reply
2 replies
5 years ago
How does CNN still exist? They are horrific
153
Reply
2 replies
5 years ago (edited)
Where is the footage from cctv ? We never see them. Was the guy shooting an empty place?.
173
Reply
13 replies
5 years ago
I don't see anyone except one man not running but casually behind in the next room and the camera man. There would be people running all over the place and people on the ground .
335
Reply
85 replies
5 years ago
I would never think to pull out my cellphone during a shooting... Why? Because I don't want to film my own death or someone else's. This seems to be the only bar without interior/exterior cameras... and if they do have them, where is that footage?
11
Reply
1 reply
5 years ago
THE ROOM WAS EMPTY!!! LET THAT SINK IN PEOPLE!!! YOU ARE BEING PLAYED!!!
279
Reply

Figure 2. Many comments on YouTube suggested that the shooting (and/or video of it) had been faked because the nightclub appeared empty and silent.

ing was a hoax, a "false flag" operation. A sampling of these opinions can be found in the responses to the video linked within a CNN report (see Figure 2).

- "I don't see anyone except one man not running but casually behind in the next room and the camera man. There would be people running all over the place and people on the ground."
- "THE ROOM WAS EMPTY!!! LET THAT SINK IN PEOPLE!!! YOU ARE BEING PLAYED!!!"
- "You're telling me a club with hundreds of people and an active shooter was quiet enough for the microphone to CLEARLY pick up the sounds of glass breaking and not be drowned out by the sounds of panic?"
- "Either THAT VIDEO was staged independently of the actual incident where people may have truly been injured or it's ALL bullshit."

At first glance, it seemed like just the latest of many conspiracy videos that populate and pollute social media. Some are outright fakes, while others are real videos taken out of context by mystery mongers for clicks (for one recent example, see "Miracle of the Weeping Mary Statue Explained," SI, May/June 2024).

Just as I was about to dismiss the video, I noticed that a prominent science communicator had examined the video on his website and made the same observation but attributed a different cause: "I watched videos of the shooting last night. I heard the gunshots. But I didn't hear people screaming, because we as a society now know that in an active shooter situation, you don't scream because that draws extra attention to you" (Broadbent 2018).

That seemed like an improbable aspect of the attacks. No one screamed as someone shot people in the nightclub? Dozens of people were silent—well, as silent as a country music nightclub would be—and careful not to yell or make a noise lest they draw attention? After the attack had begun, of course, the circumstances would change. Potential victims hiding and staying silent in the presence of enemies with weapons is nothing new; it's been a defensive tactic for millennia and was described in accounts of the Columbine school shootings in 1999. But perhaps in today's world where shootings seem common, the crowds in the Borderline Bar really did have the savvy and self-control to keep silent during the attack. It certainly seemed more plausible than some sort of conspiracy.

I returned to the conspiracy comments, and one in particular jumped out:

> WTF did I just watch? A video of an empty bar and then audio of gunshots. What happened to the 100s of people who were supposedly partying and line dancing? Where was all the mayhem that ensued afterwards? What, no one screaming? No one diving for cover on the floor. No stampede for the doorways and no one throwing chairs through windows? Oh my how horrific this video is indeed. It seems to contradict the eyewitness accounts. I'm calling BS.

Despite the clear conspiracy tone of this post, it's a fair and accurate statement. So how can we explain it?

I sought out original sources and read many interviews with survivors, none of whom mentioned the eerie silence from the killer's potential victims that the video seemed to depict. Instead, they described chaos: people yelling, screaming, and shouting. One victim, Bryce Colvard, described his friends shouting at him to get down; another student, Teylor Whittler, said that during the shooting "Everyone just yelled, 'Run, he's coming!'" and so on. Multiple news reports described victims screaming and yelling (Karimi et al. 2018).

It got me wondering why anyone would think or assume that the club's victims were silent during such a terrifying scene. Where did that odd bit of misinformation come from?

The Video versus the Victims

We can examine this through the lens of critical thinking, science, and skepticism. On one hand, we have dozens of eyewitnesses who described the horror they saw and heard, including shouting and screaming; on the other hand, we have a short, ambiguous video clip that, superficially, seems to contradict them.

In fact, there's no contradiction. Eyewitnesses, such as Holden Harrah interviewed on the *Today Show*, stated that Long appeared at the door and immediately began shooting people. News reports state that the attacker fired at least sixty rounds; of those, about nine or ten can be heard in the video ("Eyewitness Details Horror" 2018). Thus, we are seeing about one-sixth of the number of shots fired, with the balance coming before and/or after the video was recorded.

The dance floor was largely (or entirely) empty when the video was recorded because by that point the shooting had been going on for some time; it only takes a few seconds to clear a small dance floor. The room is very dark, and no victims can be seen; if there are any, they're hiding behind tables, are in other rooms, or are already outside. It's true that *in that video clip* there's no loud screaming—because the place is mostly empty at that point; few if any of the fifty or so patrons originally in the main room were left. There were reportedly about 200 people on the premises, including cooks, staff, and people in other rooms, most of whom fled in other directions and never directly encountered the shooter; the video depicts Knapp moving from the dance floor to the exit in seconds.

No music can be heard in the clip either—not because no music was being played that night at the nightclub (a strange oversight if the whole thing had in fact been staged) but because the music, like the screaming, ceased soon after the shooting began. There's nothing unusual or suspicious about it. We would not expect to hear people screaming in that room for the same reason we would not expect to see a full dance floor. It's like watching a video taken by a driver after a car accident and finding it curious or suspicious that the footage doesn't show the entire event *before* the cars collided. Why would it? Just because we don't see some specific aspect of an event in a short video clip of that event doesn't mean it didn't happen; absence of evidence is not evidence of absence.

Conspiracy theorists found it suspicious that more videos of the shooting have not been made public. It seems likely that most of the victims that night were too busy running or hiding to pull out their cell phones and record the events; that one (brave or foolish, take your pick) person did isn't particularly surprising. There are likely additional videos from police body cameras and security systems that have been reviewed by police but may not have been made public. Because the suspect is dead, there was no criminal trial and no necessary reason to release any videos. Authorities are not legally obligated to release any and all information about a crime simply to satisfy the morbidly curious and conspiracy theorists. (And, of course, such videos will not satisfy the conspiracy minded: "Yeah, so if this is real, why wasn't this video released right away? FAKE!!!").

Anyone can make mistaken assumptions; we all do it. It's not a question of believing the victims *or* believing the video; we can do both if we examine the evidence closely—and we must be careful not to create contradictions where none exist, because those are the building blocks of conspiracies. ■

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From Gods to Gurus: The Evolution of Olympic Superstition and Pseudoscience

NICK TILLER

Milo of Croton once outwrestled a lion. On another occasion, he tied a cord around his head and snapped the band using only the bulging veins in his temples. He drank ox blood for fuel and ate raw flesh to scare his rivals. Born in the sixth century BCE (no prizes for guessing where) and standing nearly seven feet tall, Milo was a giant of the ancient Olympics. The legend for which he's most well-known describes how he acquired his renowned strength—by carrying a newborn ox calf on his shoulders every day as it grew into a bull. I often recount the tale to my physiology students when explaining the training principle of *progressive overload*. Although time has blurred the boundary between fact and folklore, two details about Milo are indisputable: he won the Olympic wrestling contest on six consecutive occasions, and he commanded the Crotoniate army in its victory over the Sybarites.[1] Like all champions of the ancient games, Milo was celebrated and immortalized.

The ancient Olympics were steeped in cultural and religious superstition. In fact, Olympians such as Milo were obligated to follow pagan customs that to us appear primitive and gratuitous. Competitors ritualistically cleansed and purified their bodies to shed impurities. Athletes visited shrines and made offerings of animals and food to appease the gods to which the Games were dedicated. And, in a practice that's endured the ages, they drank concoctions of herbs and plants to cure their ailments, promote recovery, and boost their stamina. On the third day of every Olympics, at an altar fashioned from the ashes of animal bones, Grecian priests sacrificed 100 oxen in tribute to Zeus, king of the gods and ruler of Olympus.

The period separating the death of the ancient games in Olympia and its rebirth in Athens over 1,500 years later saw a profound evolution in cultural norms punctuated by two events. First, of course, was the Scientific Revolution (circa 1543), which

Even Milo's death is shrouded in myth. In a fitting end to his legendary life, Milo apparently came upon a tree that had been partially split by a wedge. To demonstrate his strength, Milo tried to tear the trunk in half, but the wedge fell out and the tree closed on his hand. Unable to escape the tree's grasp, Milo was eventually set upon and devoured by a pack of wolves. *Credit: Pierre Puget — David Monniaux (Wikipedia).*

brought empiricism to the masses. Divine beliefs were gradually traded in for natural phenomena: celestial bodies in the night sky became the stars and planets, the wrath of Zeus that terrified the ancients became electrostatic discharge, and the evil spirits causing disease were discovered to be viruses and bacteria. The Enlightenment followed (circa 1685), reinforcing rational and secular values and advocating for the separation of church and state.

By the aging part of the 1800s, science had a monopoly on public discourse, loosening the hold of religion on the Olympic games. The modern event still begins with a grand procession, but the athletes and coaches don't wind their way through religious sanctuaries and shrines. Athletes still compete for honor but that of their countries, not their gods. Participants continue to cross their chests and kneel in prayer before competing, but typically through choice rather than an obligation to the organizing committee. Ritualistic slaughter is frowned upon. In fact, today's Olympians benefit from technologies that the ancient Greeks would have branded as witchcraft but that drive our relentless pursuit of *Citius, Altius, Fortius* (the Olympic motto: Faster, Higher, Stronger). We have the power to determine which training interventions are useful and which are not, and we owe it all to science and secularism.

And yet the mere existence of science leads to its inevitable abuse. Science misappropriation is now a lucrative business, with health gurus and snake oil salesmen occupying cyberspace and exploiting a dangerous brew of blunted critical faculties and lack of commercial regulation. Pseudoscience thrives, extending its tendrils into every corner of society. To say sport hasn't been spared would be an understatement; actually, we've shaken off the magico-religious ideals of the ancient Olympiad and replaced them with the pseudoscientific ideals of the modern one.

Scene from a fifth century BCE Athenian stamnos (Greek vase), showing a sacrifice carried out by victorious athletes in the presence of the winged goddess Nike. Item at the British Museum, London, United Kingdom.

The Games of the XXXIII Olympiad are just around the corner. As an exercise scientist who was formerly a physiologist at the British Olympic Center, I've seen pseudoscience infiltrate high-level sport, and I've battled it with unbiased professionalism. But as a lifelong exerciser, it's become personal. Athletes and their teams continue to blend proven, unproven, and disproven strategies at the modern Games. What do these strategies look like? How do plausible and implausible claims coexist in sport? And why do some athletes cling to their lucky shorts, charms, and trinkets?

From the Plausible to the Wretchedly Implausible

You needn't look far for examples of Olympic pseudoscience. It's not that all Olympians have a penchant for poppycock, but there are enough high-profile ones to poison the well. American swimmer Michael Phelps—arguably the most successful athlete in history—triggered my interest in Olympic pseudoscience in 2016. While the world watched in awe as Phelps added five gold medals to his tally in Rio de Janeiro, I was focused on the large purple bruises across his back and shoulders; I knew that cupping therapy had left its mark. In a typical session of this ancient Chinese "medicine," suction is created on the skin using small glass cups and a suction or heating device. Proponents claim it stimulates energy flow and draws toxins from the body, but scientists such as Edzard Ernst say it's poorly studied and largely ineffective (Kim et al. 2011), and Steven Novella calls it pseudoscience (Novella 2016). Phelps has been using cupping in his Olympic preparations for years. "I've done it before meets," he said to *The New York Times* in 2016, "pretty much every meet I go to." The swimmer recently launched his own cupping device (Tiller 2023), completing his transition from bearing the marks of pseudoscience to championing its cause.

Cupping is one of several complementary and alternative medicines (CAMs), including chiropractic and acupuncture, being used in elite sport. In fact, 50–80 percent of athletes have used some form of CAM (Tiller et al. 2022), with numbers generally higher at the elite than recreational level. What's more, CAM has been prescribed by 88 percent of physicians for sports-related pathologies (Kent et al. 2020).

Other popular treatments, such as whole-body cryotherapy, aren't CAM *per se* but result in considerable harm by conflating plausible and implausible claims. For instance, British distance runner and multi-time Olympic gold medalist Mo Farah made whole-body cryotherapy a regular part of his recovery program, convinced that two- to four-minute exposures in freezing air could reduce inflammation. He said, "It helps you to recover when you've done really hard training or racing." The official website of the modern Olympic Games considers whole-body cryotherapy an important component of its "Athletes and Sciences" educational toolkit, proudly showcasing young athletes

receiving the treatment at the National Sports Institute in Paris. But the evidence for cryotherapy's effect is unimpressive (Tiller 2021). At best, it's an understudied strategy with perceived benefits on muscle soreness; at worst, it's an expensive and potentially dangerous pseudoscience that detracts from more effective modes of recovery.

At the macro scale, some practices have become ingrained in sporting culture because people confuse visibility with efficacy, a phenomenon called the *exposure effect*. This circular logic describes the popularity of K-Tape—the conspicuous multi-colored tape you see plastered on athletic shoulders and thighs. It's sold with claims of "improved lymphatic flow" and decreased risk of injury, but the evidence is overwhelming negative. I wrote about K-Tape for Skeptical Inquirer in 2022, highlighting a dozen reviews and meta-analyses that agree there are no benefits on injury risk; not for the shoulder, lower-back, knee, or ankle (Tiller 2022). Why, then, does the practice endure? Well, in a stroke of marketing brilliance in 2008, just before the Beijing Olympics, more than 50,000 rolls of tape were donated to athletes and sports teams in more than fifty countries. The tape was subsequently displayed like performance art on the body parts of athletes in various televised sports, particularly track and field and beach volleyball, providing exposure that no published study could rival. K-Tape is now a major sponsor of the USA Track Team, the National Basketball Athletic Trainers' Association, and the Women's Football Alliance, among others. It's difficult to find an intervention with such a disparate popularity-to-evidence ratio, but when it comes to pseudoscience in sport, popularity trumps science.

Pseudoscience aside, Olympic sport has retained undertones of superstition and irrationality from the ancient games. Judo medalist turned professional cage fighter Kayla Harrison has lucky socks that she wears during competition: "I'm big on ritual, and I'm big on patterns … and when I get comfortable [and] confident … I win." Before every event, Hungarian track skater Shaolin Sandor Liu touches his right eyebrow, then his left, and winks at the camera because he believes it brings him good luck. And American swimmer Stephanie Rice believes in numerology; before each race, she swings her arms eight times, splashes her body with water four times, and presses her goggles to her face four times.

"Once it becomes a habit, superstitions are self-sustaining," wrote Stuart Vyse. "In those situations when control is lacking, superstitions provide sufficient psychological benefit to keep people wearing lucky ties and performing pre-game rituals" (Vyse 2023).

This means that although superstitions and rituals don't work in the literal sense—by influencing the speed of a run, the height of a jump, or the flight of a javelin—they may have an indirect utility by conferring a semblance of control. So, could this subsequently confer a performance advantage in sport? A 2010 study from the University of Cologne, Germany, put the question to the test. Twenty-eight students, most of whom believed in good luck, were invited to a lab to perform a golf putting task: ten putts from 100 cm into a stationary cup. Half the group performed the task as normal without any priming. However, the

Credit: Leonard Zhukovsky | shutterstock.com

other half had their superstitions "activated"—when handed the ball, they were told by the researcher, "Here is your ball. So far it has turned out to be a lucky ball." As you've probably guessed, the subjects using the "lucky" ball performed significantly better, sinking an average of 6.4 putts versus 4.8 putts by the control group. Although efforts to repeat the trial have produced mixed results, it was one of the first studies to suggest a benefit of superstition on skill execution.

Elite sport is, therefore, a world where science, pseudoscience, and superstition have become interconnected. Olympic athletes are susceptible to imagined effects, and the evidence is everywhere. So, what is it about the modern sporting world that has athletes suspending their skepticism in favor of rituals, miraculous thinking, and baseless commercial claims?

Win at All Costs?

My office at the Olympic Center had a small window that peered into our adjacent exercise physiology lab. Every few days, an injured rower from the national team would stop by to use a stationary bike and take on "The Big 30"—a thirty-minute cycling test designed to keep athletes motivated while they are away from formal competition rehabilitating their injuries. The higher their average power output during the trial, the higher on

the leaderboard they finished. It was a grueling challenge that the rowers took very seriously.

One Tuesday afternoon, I heard grunting and groaning echoing throughout the lab. I craned my neck, looked through the window, and saw a large, muscular woman pedaling furiously. A half-empty bottle of sports drink had been tossed on the floor, and the large digital timer on the wall read "25 min 30 sec." Her face was twisted in a grimace. It was obvious she was in immense pain and struggling to maintain her power in the closing minutes of the test. She was alone; no coaches to offer instruction, and no audience or peers to offer support. Then, without warning, she vomited. Sports drink and stomach acid spewed from her mouth. It covered her legs, the pedals, and pooled on the floor. I ran to the lab and flung open the doors to offer medical aid. *She was still pedaling*. Her legs were cranking on the pedals like hydraulic pistons. She heaved a second time, but the digital power display barely wavered. When the thirty minutes had elapsed, I sidestepped the vomit and caught her just as she toppled from the saddle like a felled tree.

Elite athletes are blessed with immense determination, a unique stubbornness, and a refusal to quit even when they're sick on their own legs. Unlike sports at the recreational level, elites aren't interested in taking part; winning is all that matters. It's an ethos that trickles from the top down, from the performance director to the head coaches and the athletes.

This obsession with victory has evolved out of necessity because success and failure at the games are separated by a rapidly shrinking margin. For instance, the women's 100-meter final in Barcelona in 1992 had five athletes cross the finish line within one-tenth of a second (a slow-motion replay eventually awarded the gold medal to Gail Devers of the United States). And at the Pentathlon final in Montreal in 1976, eight athletes entered the final event in gold-medal contention; 200 meters and twenty-five seconds later, Siegrun Siegl of East Germany had leapfrogged six athletes to move from seventh place to first. In sport, victory can be snatched in a hiccup.

And not just victory but also prize money. Athletes returning to the United States with gold medals around their necks are awarded between $15,000 and $37,500, depending on the sport. It doesn't go far. Italian victors are awarded up to $200,000, but even this small fortune quickly dwindles when living expenses, training fees, and coaching fees are settled. Plus, there's just one prize per sport every four years. Bring a gold medal back to the United Kingdom and you'll get a hardy handshake from the prime minister—if you're lucky. So, victory and financial stability for modern-day Olympians is a rare, fragile, and highly sought-after commodity.

In this hypercompetitive ecosystem, as high-pressure as any vocation on Earth, pursuing every performance advantage, no matter how small, is second nature. This is the philosophy of marginal gains (Slater 2012), and it makes athletes and their coaches increasingly experimental. All treatments, whether they're natural or supernatural, evidence-based or not, are tossed in the melting pot of possibilities, justified by the notion that every percentage point counts. Any effect, even an imagined one, could be the difference between gold and silver—that vital one-tenth of a second. And with such lax health and wellness regulations, athletes are free to try all the products and services they wish.

This is not to say that pseudoscience and superstition necessarily predominate. There are many athletes and teams who revere science and trust their support staff to give practical, evidence-based advice. Elite athletes are also data-driven, obsessing over power output, stroke rate, stride length, and all the metrics we can record with modern technology. But most Olympians are underpaid, financially incentivized, and desperate for outcomes, real or imagined; these are the very conditions where pseudoscience thrives. In a world where athletes are groping for a semblance of security, pseudoscience offers something that science cannot. As Isaac Asimov wrote in his 1972 *Guide to Science*: "Inspect every piece of pseudoscience and you will find a security blanket."

The Price of Placebo

Scientists and doctors are integral pieces of any sports performance puzzle. They work alongside athletes and coaches, often embedded full time, advising on training, nutrition, and injury management. And yet they regularly err in the face of snake oil and pseudoscience. Why?

Because placebos work. Expectation and belief are powerful psychobiological palliatives, used by coaches to give their athletes a psychological edge (Trojian and Beedie 2008). Placebo effects cannot be underestimated in Olympic sport. "For someone like [Michael] Phelps who is at the very end of the bell curve," says our friend Timothy Caulfield, "that slight effect that you might get from some therapy, whether it is placebo or otherwise, can be significant and have a significant impact on outcome."

I have several firsthand accounts of coaches pursuing the psychological advantage through placebos. I was once asked by the head of a national team to implement a twelve-week altitude-training program for the athletes in my charge. The intervention would have them training twice per week in our environmental chamber—a large room in which the oxygen content had been reduced to 16 percent—on the premise it would stimulate red blood cell production and enhance endurance. I was hesitant. It was not only a considerable drain on resources, but we also had no idea if the strategy would help or hinder performance, and I wasn't prepared to take responsibility for something with unknown outcomes. I proposed what I thought was a reasonable compromise: a controlled study. Half the team would use the chamber, the other half would train as normal, and we'd measure blood biomarkers before and after the intervention to assess for benefits.

"I don't think so," said the coach, shaking his head, "I want everyone in the chamber. Even if they think it works, that's good enough."

So, that's what we did.

In elite sport, athletes are the soldiers, but coaches are the generals, spearheading training and strategy in pursuit of victory. When a coach decides to preserve the status quo and use a placebo as a psychological aid, scientists and physicians must acquiesce. Even those embedded in the sport full time, as I was,

are powerless to challenge established norms because it means tugging at the threads that bind the structures together. Nobody wants to risk destabilizing the system when medals and prize money are on the line, and who can blame them? We subsequently leave placebos, even disproven alternative therapies, in place. After all, *what's the harm?*

What's the Harm?

But there's a perilous downside to such acquiescence. These "therapies" aren't benign: cupping can cause burns and infection (Jing-Chun et al. 2014), acupuncture can lead to soft tissue injury and even pneumothorax (punctured lung) if the needles are incorrectly placed (Ernst 2010), and chiropractic can result in vertebral artery dissection and stroke (Jones et al. 2015). And while all medical procedures carry risks—balanced by physicians in risk-to-benefit assessments—the benefits of alternative therapies hinge on imagined effects. This makes the risks much harder to justify.

It's also impossible to restrict so-called placebo products to sports, health, and fitness. If someone believes in the healing power of a placebo, it's a matter of time before they'll use it to treat something that needs a science-based medical intervention. Cupping was used by Phelps to treat his muscle soreness, but the British Cupping Society propose it as a treatment for asthmatic symptoms and even fertility. Cryotherapy is used at the Olympic Institute to "speed recovery," but others claim it can treat diseases such as arthritis and multiple sclerosis. Sports-based placebos inevitably bleed into mainstream culture, affecting clinical practice. Databases such as whatstheharm.net have documented nearly 400,000 deaths and around $3 billion in economic damages due to the inappropriate and negligent use of unregulated alternative therapies.

This says nothing of the effect that athlete endorsements of ineffective products have on population health. According to consumer analytics firm CivicScience, products endorsed by fitness influencers—including high-profile athletes—are more likely to sell than products endorsed by regular celebrities who are not on social media. The day after Phelps thrust cupping under the spotlight, Wikipedia page views for "cupping therapy" reached an all-time high, spiking to over 100,000. It shows that athletes are pioneering population trends in the use of health and wellness products. Members of the public pursuing better cardiometabolic health therefore turn to antioxidant supplements and keto diets; people with injuries turn to cupping and acupuncture; people trying to lose weight turn to ineffective fad diets and dietary supplements. It's difficult enough convincing people to care about their health and wellness without seeing them fail in their attempts because they squandered time and resources on insubstantial, potentially harmful quick fixes.

A Sci-Comm Reformation

The strands of pseudoscience that weave their way through Olympic sport are hard to untangle, but we must keep tugging at the threads. We'd be in a considerably better position to limit the harm and spread of pseudoscience in sport if we could address three problems: (1) athletes and coaches often prefer the views of their peers to those of scientific experts (Fullagar et al. 2015); (2) there's a lack of understanding of how placebo products and CAM in sport can affect the wider population; and (3) the public have a poor understanding of basic physical activity and nutrition guidelines (Vaara et al. 2019; ASN Staff 2022), such that they're more susceptible to baseless claims and pseudoscience. There's no cure-all, but better science communication (sci-comm) might be the stone that clips all three birds.

There's no doubt that science is being lost in translation; something is obstructing the path of new findings from the lab to the layperson. There's been progress on this front, but science journalism is still laced with biases and conflicts of interest (Hone and Hone 2014). I toss some of the blame at the feet of scientists like me.

Research in "sports science" has proliferated at an unprecedented rate with more studies being published in the past decade than in the past five decades. But this mounting body of data hasn't been matched by increased efforts by scientists to communicate their findings to the public. We publish in academic journals that incarcerate reports behind paywalls, write in stuffy and unintelligible prose, and communicate with other scientists in esoteric silos. Scientists are unwilling to engage with the public because there's a stigma that those who do are somehow worse academics, something called the Sagan Effect (Martinez-Conde 2016).

The subsequent sci-comm void has been gratefully filled by fitness influencers, wellness gurus, and the mainstream media, none of whom have a nuanced understanding of the science or their audiences' best interests at heart. According to the American Council on Science and Health, science reporting is in a bad way: "If journalism as a whole is bad (and it is)," says the Council, "science journalism is even worse. Not only is it susceptible to the same sorts of biases that afflict regular journalism, but it is uniquely vulnerable to outrageous sensationalism" ("Science Journalism Can Be Evidence-Based" 2017).

My warning to scientists: If you don't tell your story, someone else will tell it for you, and you may not like how they do it.[2] Therefore, we must do a better job of shepherding new research findings across the divide.

I've been able to modestly influence this process in my capacity as an associate editor at *The International Journal of Sports Nutrition and Exercise Metabolism*. We recently launched an initiative called the Non-Technical Summary—a simple organizational change that requires all submissions to the journal be accompanied by an independent 1,000-word summary written in clear, nontechnical language. The report is designed to make new research accessible to members of the public who don't have expertise in the area: subgroups of athletes and coaches, science enthusiasts, journalists, science writers, and scientists in other disciplines. As far as I'm aware, it's the first initiative of its kind in the discipline, one that I hope will inspire similar moves at other journals. Moreover, although it's but a single step, it could take us closer to bridging the gap between science and the mainstream, reducing the public's dependence on flawed third-party scientific interpretations and rebuilding public trust in scientific institutions.

* * *

The ancient Olympics were steeped in religious customs and superstition. We've shaken much of the dogma, but the residuals of superstition remain, and we've replaced religious beliefs with pseudoscientific ones that have the potential to cause considerable harm.

Fortunately, there's reason for optimism. With continued work in science education and, more importantly, communication, the culture of the games will continue to evolve. Eventually, the grip that pseudoscience has on sport may well be snapped like a cord wrapped around Milo's head. In the meantime, we must continue to train our critical faculties and build the bulging forehead veins of scientific skepticism.

Elite sport operates at the extremes, at the intersection of financial incentives and a *win at all costs* mentality. It's a dangerous combination where snake oil is an attractive panacea. Science can lead to science abuse just as alcohol can lead to alcohol abuse. So, my message to the sporting world is simple: think responsibly. ■

Notes

1. An honor Milo performed armed with a club, with his Olympic wreaths around his neck, and while draped in a lion's skin like Hercules (Diodorus 1814).

2. I have paraphrased Dr. Shirley Malcolm of the American Association of the Advancement of Science, but I couldn't find a direct quote to attribute to her.

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For more, read Nick Tiller's article **"From the Lab to the Layperson: A Pioneering Initiative to Improve the Translation of Science"**

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Curing with Charm: Folkloric Faith Healing and the Power of Belief

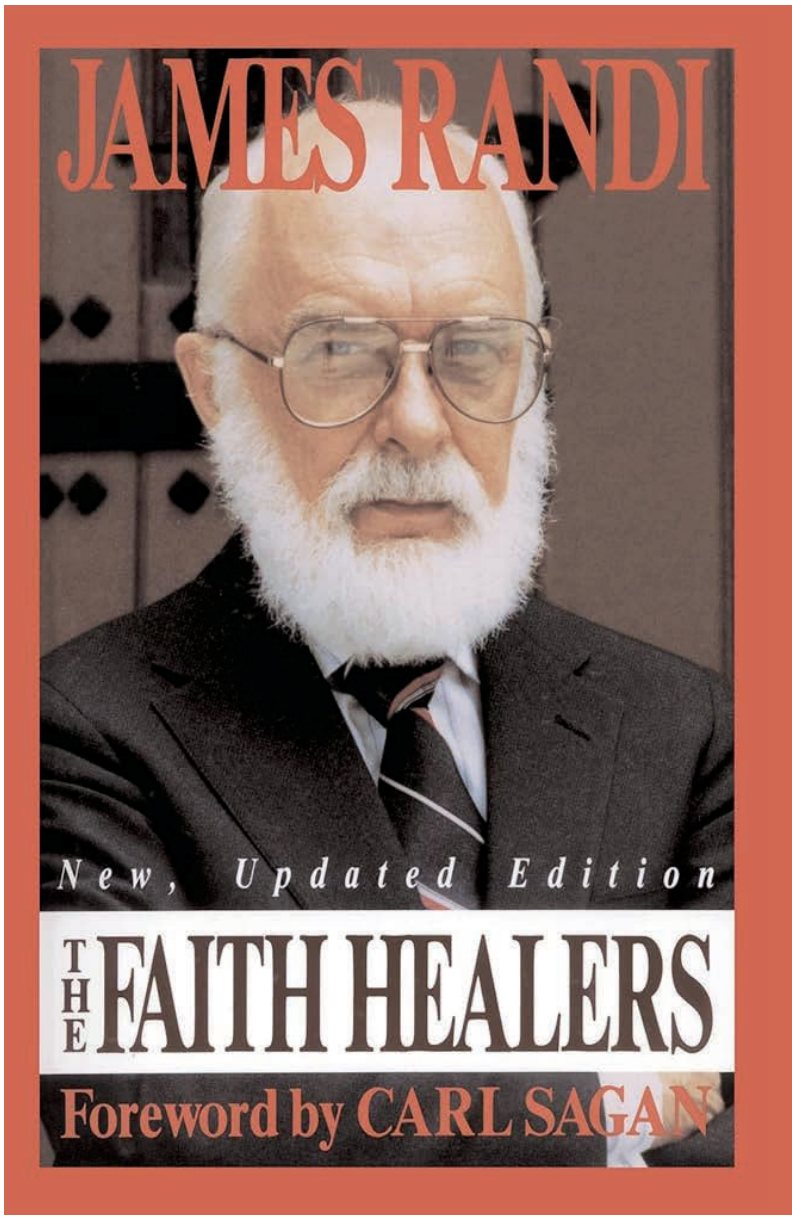
DANIEL A. REED

Faith healing and other "gifts" allegedly bestowed upon the faithful through preternatural means have long been examined by the skeptical community. For example, in his book *The Faith Healers* (1989), James Randi provides a comprehensive examination of faith healing and offers several keen insights into the subject. While skeptics have uncovered fraud and deception in the practice of faith healing, many people truly believe they can heal themselves or others through spiritual or faith-based practices. Why might people hold these beliefs despite a lack of clear empirical evidence for effectiveness?

The study of folk cures provides some insight. As Randi (1989, 13) noted, "Sickness is one of the basic problems of mankind," and people around the world have sought ways to restore health and improve well-being—sometimes resulting in questionable treatments and quackery. For example, an article from 1898 titled "Folk Cures from Kansas" lists no fewer than twenty-eight questionable techniques for removing warts, some of which were also found in central Appalachia and documented in 1975 (Davenport 1898, 129–132; Gainer 2008, 110). One method discussed by both sources is washing one's hands in "stump water" to remove warts. Interestingly, this method is also referenced by Mark Twain in chapter six of *The Adventures of Tom Sawyer*, along with other questionable techniques for removing warts with which Tom and Huck were familiar, including some rather dubious and unpleasant business involving the burial of a dead cat.

Still, while the nature of "magico-religious healing" (Baldwin 1992, 41) found in folklore and classical literature is intriguing, we are still faced with the question of *why* there are those who believe in the efficacy of not only the cure itself but of their own ability to effect these types of cures. To better understand this phenomenon, let's examine a specific region: central Appalachia of the United States.

Appalachia is an expansive area in the eastern United States that consists of "423 counties across thirteen states and spans 206,000 square miles from southern New York to northern Mississippi" (Appalachian Regional Commission 2023). Settled primarily by Scottish, Irish, German, and English settlers in the eighteenth and nineteenth centuries (Cavallari 2023; United States Forest Service 2008), those who settled in the area were "known as hearty people" who lived in a very "difficult environment" (Cavallari 2023). The photographs in this article stand as testament to this, depicting life in Appalachia during the early 1900s.



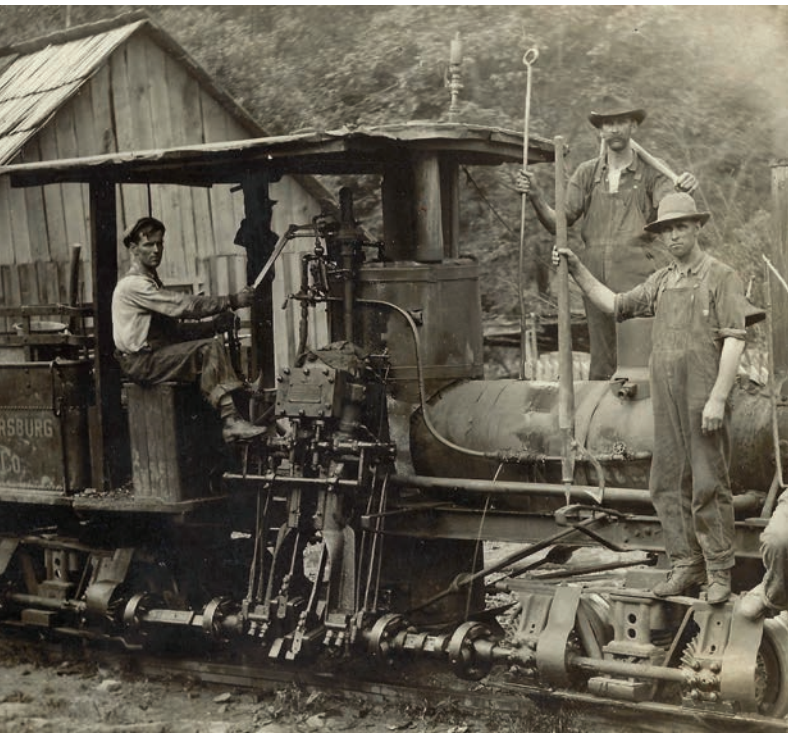
As settlers established themselves in this area, the hilly and mountainous topography had a significant impact on the formation of townships and travel routes, because navigating and settling the rugged terrain was exceptionally difficult. In the

The family business in early Appalachia. The author's great grandfather, the area blacksmith, stands beside a pile of old horseshoes outside his blacksmith shop. Other family members stand in the background. Source: Author's family archives.

past, "communities generally consisted of small clusters of two or three homes within walking distance of each other." Small, self-sufficient towns containing "one or two stores, a mill, a church, and a school" dotted the landscape of the area, with larger towns that were "widely scattered" and "divided by hills and ridges (United States Forest Service 2008). Because of the relative isolation of the region, the area grew to promote a "social and political structure that emphasized independence and equality" (United States Forest Service 2008), characteristics still prominent today throughout the region.

As in days gone by, small townships are still scattered across Appalachia. While smaller urban areas now have access to health clinics and medical facilities, it is still common for physicians to travel between towns to provide medical care, just like their counterparts in previous generations. Despite the availability of medical care, self-treatment and "common folk" providing medical treatment for family members and friends is still widespread. It is in the rural communities of the central region of this area where we will focus our exploration, for it is here where we find a wealth of healthlore.

In Appalachia, there are stories of individuals who, much like the prophets of old in the Bible, were said to be granted certain mystical abilities from God. It is said that they allegedly had the "power of healing, of finding water underground ["water witching"], of finding lost articles, of prophesying, and of communicating with the spiritual world" (Gainer 2008, 140). While some are said to be born with these abilities, it was held that "any person who has great faith may be capable of healing illness" or performing other such acts



Work injuries were common and could be severe in the late 1800s and early 1900s. Proper medical attention could be difficult to find, leaving it to the locals to "take care of their own." Here, workers from a lumber mill take a break to have their photograph taken. Source: Author's family archives.

An example of day-to-day life from one of the small towns that dotted the landscape of early Appalachia, Waldeck, West Virginia. Source: Author's family archives.

using prayer (Gainer 2008, 140). My great-grandmother was said to be such a person (see photograph at right). There are stories in our family of how she was supposed to be able to remove warts, stop wounds from bleeding, "blow out" fire from a burn wound, and predict the sex of babies yet to be born. True to the ideal of Appalachian independence, she ended up delivering several babies in her local community whose sex she allegedly correctly predicted, as doctors in the rural areas of central West Virginia were a scarce commodity during the late 1800s and early 1900s. Stories of people like her were not uncommon, and there are similarities in the various narratives with respect to their acclaimed faith-healing abilities (Wigginton 1972, 346–368).

What are we to make of these stories? If we look beyond the lore and consider the stories' claims of the supernatural, what conclusions can we draw based on the available information?

A picture of the author's great-grandmother, "Granny Lucy" as she was known. She was alleged to have the ability to remove warts, stop wounds from bleeding, and predict the sex of a child that was yet to be born. She provided care for all manner of wounds, illnesses, and medical conditions in her local community. Source: Author's family archives.

To Bleed or Not to Bleed. That Is the Question

As folklore, the ability of faith healers to make a wound stop bleeding by employing an incantation, prayer, or perhaps even through reading a verse from the Bible[1] sounds amazing. Yet when we examine the physiology of bleeding wounds, we find that supernatural explanations are unnecessary. For most healthy people, blood will clot of its own accord, and bleeding from a wound will stop, especially in the case of smaller cuts (Cleveland Clinic 2022). This can be expedited by using a handkerchief or other piece of cloth and applying a bit of pressure (which, perhaps in the excitement of the moment, is applied unwittingly by the person holding the cloth) to assist in staunching the flow of blood. "All bleeding stops eventually, especially in more superficial wounds that do not include arterial involvement," says Dr. Hilary Miller, Doctor of Osteopathic Medicine, who owns and operates a rural health care clinic in central West Virginia. "It is the body's job to release coagulation factors to cause clotting and stop bleeding, and any amount of applied pressure speeds the process by helping to constrict the vessels and concentrate the clotting factors. Other influences are at play as well," says Miller, speaking to the psychological effects that a healer may have on someone who is wounded. "Having something comforting recited to them, like a Bible verse or a prayer, can have a calming effect on a wounded person, which can lower their blood pressure and thus decrease the force of the bleeding, thereby helping coagulation to occur" (Miller 2022).

Is it then reasonable to conclude that the cessation of blood flowing from a wound, as described in folklore, is best attributed to supernatural forces? Or is it more probable that individuals mistakenly believe that the ritual caused the bleeding to stop—due to a *post hoc ergo propter hoc* ("after this, therefore because of this") fallacy? Occam's razor, a premise that asserts the explanation with the fewest new assumptions is the most likely to be correct, would clearly favor the latter. As a healer conducts their ritual, the body's natural processes of clotting and healing take place, resulting in a cessation of the wound's bleeding. However, those unfamiliar with the natural physiological processes of the human body who see the event may feel they have witnessed something miraculous. Also, by its nature, blood from wounds is typically both painful and alarming, (understandably) resulting in immediate efforts to staunch the flow. Thus, people have little experience with comparable situations in which a wound is left untreated and the blood soon stops on its own.

Wart-Be-Gone

As discussed, some healers (or "practitioners") are alleged to possess the mystical ability to remove warts. In stories related to this feat, individuals who are beset by either one or multiple warts are seen by a practitioner. The patient is instructed to perform some act, such as rubbing the wart(s) with a stolen dishcloth and then instructed to bury it (Gainer 2008, 110). In other stories, the practitioner directs the patient to touch each wart with a separate kernel of corn, say some phrase, and then feed the wart-tainted corn kernels to chickens (Pressley 2021b). Indeed, there are several methods for removing warts listed by Gainer in his book *Witches, Ghosts, and Signs*, but all are equally as questionable as those already

mentioned (Gainer 2008, 110). Alternatively, there are reports of practitioners who would simply murmur some indiscernible words while rubbing the afflicted areas (Pressley 2021b). By all accounts this is the method that was employed by my great-grandmother. It was said that she would take the person by the hand, close her eyes, mumble something under her breath, and then rub each wart. When she was finished, she would say something akin to, "Now don't you worry about them anymore. They'll go away."

How long does it take for the warts to disappear after the ritual? Apparently, time varied depending on the technique employed. For example, if one steals a dishcloth, rubs the wart with it, and then buries the cloth, it is said that the wart will disappear when the cloth decomposes (Gainer 2008, 110), a process that could take a while depending on soil conditions and fabric content. In other stories, such as in the ones I grew up hearing about my great-grandmother, the warts just simply disappeared "after a while"—an unexacting timeframe, to say the least. Whether magically eliminated via a decomposing dishcloth or an indiscernible incantation, as the stories go, after the performance of the ritual, even the most persistent cases of warts are said to fade into nonexistence.

How might we account for this phenomenon? Are supernatural wart-banishing forces at work, or might a more prosaic explanation suffice? "The transitory nature of most types of warts is a well-established fact, especially in children," says Dr. Hilary Miller. "Being caused by a virus, the body naturally fights them off, and barring some type of underlying immunological condition, warts will usually go away on their own" (Miller 2022). Other medical sources speak to the transient nature of warts as well; the National Center for Biotechnology Information reports, "Studies involving school-age children and teenagers showed that about 50%" of those reporting to have warts, "no longer had any warts after one year," and that "after two years, about 70% no longer had any warts" (National Center for Biotechnology Information 2019).

Once again, the *post hoc ergo propter hoc* fallacy provides a plausible explanation. In all these examples, we see instances wherein a practitioner performs a ritual, or instructs the patient to perform an act, and the warts later disappear. What follows then is the belief emerges that it was the ritual or act of the healer that caused the desired outcome, instead of the natural processes and timelines of the body's healing mechanisms. When viewed from this perspective, it becomes clear why some individuals may have faith in their own and others' abilities to perform these seemingly miraculous feats.

A Drawn-Out Burn

The practice of "drawing out" a burn, or to "blow the fire" from a burn, is another popular alleged ability of faith healers in the Appalachian region. In the *Foxfire* book, editor Elliot Wigginton speaks of the belief that when someone incurs a burn, the "fire continues to flame inside the wound" and it will "continue to burn into the flesh until it reaches the bone." It is believed (by some) that if this occurs, it then "becomes infinitely more difficult for a doctor to cure the wound" (Wigginton 1972, 347).

It is evident from this description that there is a fundamental misunderstanding of the effect of fire on body tissue. "While the effect of a burn continues to be felt for a while after the initial injury due to damage associated with the nerve endings, fire does not continue to 'flame inside a wound,' and certainly will not burn until it reaches the bone," says Miller (2022).

Once again, the *post hoc* fallacy appears to be in play. As anyone who has been even slightly burned will attest, it hurts and continues to do so for a while. But just because it feels painful, it does not mean that the fire "continues to flame" inside the wound or that it will continue to burn until it reaches the bone. Eventually the pain does fade as the body's natural healing mechanisms begin to engage. What effect does blowing on the injured area have? Is there something to the idea that the act of blowing on the burn causes the pain to lessen?

We need only look to the "gate control theory" of pain to find a reasonable explanation that might better account for what is happening. The gate control theory of pain reduction holds that if we injure two parts of the body simultaneously, the two areas of the "body 'compete' for our brain's attention" and it is "difficult for your brain to process pain from both areas at the same time" (Wendt 2002). By providing stronger active signals and stimulation to the sensitive and damaged nerve endings of the burn area by blowing on them, the brain's attention is misdirected, and it perceives the other non-painful signals from the area more readily. Subsequently, because the brain is not paying as much attention to the pain signals from the burn, the pain seems to lessen. Another example of controlling and "closing the gates of pain" is rubbing a bumped head to help ameliorate the discomfort. "When your brain perceives another stronger signal coming in, it doesn't pay as much attention to the first painful signal" it was receiving (Wendt 2002). This is basically what happens when one blows on a burn; "While the burning sensation of the pain will eventually subside naturally, by all appearances, the act of blowing on the area could give the impression that the blowing is what is causing the pain to lessen and to eventually cease" (Miller 2022).

There are other stories associated with "drawing out" a burn, wherein it is said that the healer simply holds the victim's hand and inscrutably whispers or mumbles. In some accounts, blisters fell away and skin healed instantaneously, right before the eyes of the witnesses (Pressley 2021a). While these accounts are certainly amazing, Miller notes that "I have been in medicine a long time, and I have never seen a case where tissue from a burn spontaneously healed" (Miller 2022).

Conjuring Cures for Candidiasis

The curing of thrush (a fungal yeast infection in the mouth and throat known as *Oropharyngeal candidiasis*) is another feat attributed to healers in Appalachian folklore. In the *Firefox* book, Wigginton details the exact method used by interviewee Charlie Tyler, which involves cupping one's fingers around the patient's mouth and then sharply inhaling to "suck the breath

away from the child." This act is repeated three times during a healing session, but Tyler goes on to say that there are times it may require more than one session to completely cure the condition, "because it's a germ" (Wigginton 1972, 357) and it may return.

How are these people allegedly able to cure thrush? According to the Cleveland Clinic's website, "Thrush often goes away on its own once you stop whatever is causing the problem" (Cleveland Clinic 2021) and could be caused by something as simple as not cleaning or sterilizing a pacifier properly after being used (University of Rochester Medical Center 2022). This is not to say that every case will abate if left untreated, but once again, we tend not to hear of instances in folklore wherein the healer was unsuccessful and resulted in the child being hospitalized or requiring a physician for treatment. What we *do* hear are the marvelous tales of the practitioners' abilities to heal through strange and inscrutable means. It is possible—indeed virtually certain—that there are many instances where practitioners failed, but those stories aren't noteworthy (an early version of the file drawer effect). Stories are passed down and become part of folklore because they are *interesting and notable*; few mothers are eager to tell their children of the times when their beloved grandma failed to remove someone's warts or thrush. Fanciful anecdotes do not true evidence make.

When reading of amazing feats attributed to faith healers, it becomes clear that there are accounts that plainly fall beyond our ability to rationally explain—if we accept the stories at face value. How then are we able to account for tales such as these? What is likely to have happened, really? For our thought experiment, let us say that we have someone who witnessed a healer in action, having appeared to have caused a rather nasty cut to stop bleeding or perhaps having "cured" a terrible case of warts. The individual witnesses the event and then later recalls it in conversation.

Our first consideration in questioning the veracity of the claims needs to be that of the eyewitness testimony. Eyewitness accounts can be "fickle" and "shockingly inaccurate" (Arkowitz and Lilienfeld 2010). Did the person really see what they thought they saw? Also, are they perhaps confabulating elements of the story in their recollection and the retelling of the tale? This is not to say that witnesses did not necessarily see *something* that amazed them, but how accurate is their recollection? Certainly, the research in this area would lead us to question the reliability of any witness accounts associated with the tale.

But, for the sake of argument, let us assume that the witness remembers and tells their story accurately. Without any knowledge of the body's natural healing processes, witnesses may perceive the event as incredible or even miraculous. Because of their amazement, it is reasonable to assume that the witness would then share the story with others in their community. Undoubtedly, some from this second group would be amazed by the story and would go on to retell the tale, resulting in even more retellings and potentially making the story more incredible with each subsequent iteration. Richard Dawkins describes this effect in his book *Outgrowing God*, wherein he talks about how myths develop, saying that a story "changes as it's repeated and re-repeated," and "deeds become exaggerated eventually to often superhuman levels." "All kinds of details change," as "successive storytellers 'improve' the story." Dawkins continues, "By the time the story is finally written down, little of the original survives" (Dawkins 2019, 57).

While amazing tales of supernatural healers certainly make for interesting reading, when viewed through the lenses of critical thinking and skepticism, their mysterious nature fades away. Of course, there will always be claims that defy explanation simply because we don't have enough information. As skeptics say, "I don't know how that could have happened" or "I don't have an explanation" is a perfectly acceptable position, especially when we will never have all the relevant facts surrounding these stories.

When we encounter an incredible folkloric tale that seems impossible to explain, it is essential to consider its origins, as folklore places a greater value on preserving the stories than on factual accuracy. As folklorist Jan Harold Brunvand stated, "It is not the purpose of folklore study to debunk oral traditions" (Brunvand 1981, xii). Instead, that duty falls to skeptics to investigate and determine the validity of these claims, letting the evidence speak for itself.

Even in the modern world, the belief in the power of faith healers does not simply reside in the folklore of the past. For example, in our focus area of the Appalachians, there are those practitioners who are "still relied upon by some old-school families who believe in the[ir] magical healing powers" (Jarvis 2019). In our interview, Miller stated, "In rural areas, it is not uncommon for people to try to use folk cures to take care of some fairly serious injuries or conditions themselves, when in reality they should seek medical attention" (Miller 2022). For example, what if someone believes they have a wart and subsequently goes to a faith healer to have it removed. The person waits for the wart to go away, but it doesn't, because instead of a wart, they have basal or squamous cell skin cancer. By waiting for the healer's supposed miracle, the person is wasting time that would be better spent under the care of a real physician who can recognize, diagnose, and provide proper treatment for their condition.

To be clear, belief in faith healing is not solely the provenance of the people of Appalachia, nor any other region for that matter. Despite the advances of science and modern medicine, there are those the world over who believe in the ability of others to heal via supernatural means. It is in these beliefs that the dangers lie, and it is here that our charge as skeptics begins. Whether it is examining folklore or investigating other claims of the fantastic, as skeptics, it is up to us to assist others through the application of critical analysis of the facts and evidence to find the truth, whatever it might be, warts and all. ■

Note

1. In the Bible's book of Ezekiel, Chapter 16, verse 6, one can find what is referred to as the "blood verse." It is said, "one with great faith can stop

bleeding by reciting" this verse (Gainer 2008, 140).

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The Meg: Myth of the Modern Megalodon

BRETT TAYLOR

Carcharocles megalodon (or, more recently, *Otodus megalodon*) was a carnivorous shark that made today's largest great whites look puny. The notion that the mighty megalodon shark might be alive today is a popular one, as shown by the success of the 2018 movie *The Meg* and its recent sequel, *Meg 2: The Trench*. This idea might make for good entertainment, but should we take it seriously? After all, the fossil evidence suggests megalodon went extinct more than two million years ago.

The Meg movies are based on the work of author Steve Alten, who was criticized by *Forbes* writer Priya Shulka for using "every opportunity to espouse his non-expert beliefs that the Megalodon may still exist," "re-popularizing conspiracy theories about undiscovered Megalodon populations," and "other falsehoods about the extinct predator" (Shulka 2018).

Until the 1970s, the modern megalodon myth was little explored. *Carharadon megalodon*, as it used to be called, was little known to the general public. The notion lurked occasionally in the province of "fish stories" and sailor yarns. Author and champion fisherman Zane Grey claimed to have seen an extraordinary sight while fishing in New Zealand in 1927, but the story only became widely known in 1976. Grey supposedly motioned frantically for one of his shipmates to photograph the beast, but strangely no photograph seems to have been taken. He at first thought the creature, which a comrade estimated at forty feet long, was a whale shark, but the locals convinced him that the fish he'd seen was "one of the man-eating monsters of the South Pacific."

But Grey also admitted to "absolutely" believing in the existence of sea serpents. It's no surprise that the author's son, Loren, would be skeptical, especially when Zane told Loren that "all fishermen were prone to exaggerate and he was no exception." But Loren later had to "eat crow" upon traveling with his father to the Tuamotu atolls near Tahiti in 1933. Loren spied a shape in the ocean of a "majestically yellow" color and a head at least ten feet in length. As the shape came closer, Loren was convinced this was either the same shark his father had seen six years before or one like it. He estimated the yellow fish, which was covered on its back with barnacles, was up to fifty feet long. Grey's account suggests the shark was a relative of the sand shark and the black-tipped shark, but given his description, the most likely explanation is that the creature was a misidentified whale shark (Grey 1976). Grey discounted the possibility that the creature was a whale shark because of the shape of its head and its unusual color, but the coloration of the whale shark's spots is not always the same. Whale sharks have spots that are usually described as white or creamy, but these spots can look yellowish at times.

Loren Grey does not suggest the term *megalodon*, but with his use of the phrase "prehistoric monsters of the deep," that seems to be what he is implying. As for the shape of the head, it's possible the creature was deformed or wounded in some way. And optical illusions are not unheard of on the seas, where sailors have been known to see mermaids and sea serpents more likely to be misidentified seals, eels, or oarfish. The possibility that this was a whale shark seems likelier than the extraordinary coincidence of Zane Grey being so fortunate as to be the only man on record to spot a giant prehistoric shark

Actual image of a whale shark.

twice in one lifetime—and only a few years apart! Forty-three years later, Loren still vowed to hook one of these creatures and solve the mystery once and for all (Grey 1976).

It was one thing for a salty storyteller such as Zane Grey to spin such a yarn, but it was more startling when the respected naturalist and author Peter Matthiessen put forth the suggestion in his 1971 book *Blue Meridian*: *The Search for the Great White Shark* that the Carcharadon megalodon might not be entirely extinct. Paraphrasing the theories of a Harvard comparative zoologist named James F. Clark, Matthiessen discounts the idea that megalodon died out because of a lack of food supply because huge whales have had no problem finding food over the centuries. Clark and Matthiessen think megalodon would have no need to surface because sharks lack air bladders.

Matthiessen notes an anecdote from Dr. D.G. Stead, who had a similar belief due to a single anecdotal incident in Australia, when a "great pale shark" swallowed "several" crayfish traps, each three and a half feet long. Stead considered this story "absurd," but after talking to "the veteran fishermen involved," he changed his mind. Impressed by the vivid storytelling abilities of Australian fishermen, Stead took a huge leap and decided the damage might have been due to a megalodon, when a large great white would have been a more logical culprit (Matthiessen 1971).

In the early 1970s, sharks were only beginning to be understood, and underwater photography wasn't as sophisticated. For whatever reason, nonfiction writers in this era went out on a limb to suggest the megalodon might still be alive. The year after *Blue Meridian* came out saw the publication of Richard Perry's *The Unknown Ocean*. In a move that would eventually filter into popular culture, he added a new hypothesis: the deep unexplored trenches might provide a latter-day home to giant prehistoric sharks, namely megalodon (Perry 1972).

Perry noted, "It has been asserted that this monster must have been at least 90 feet long" but "could have been smaller or larger." Perry based his assessment on the fact that the known megalodon tooth fossils were twice the size of a great white's teeth, and he used purely anecdotal evidence to assume thirty-six feet as a normal size for a great white. Thirty-six feet was a ridiculously oversized estimate, even for 1972 (Perry 1972).

By contrast, Matthiessen mentions Jacques Cousteau as seeing an Azores shark that appeared to be twenty feet long, and it's clear Cousteau thought this was unusually big. Matthiessen makes it clear the average size was much smaller, noting that Port Lincoln fisherman Jim Veitch, having "studied them for forty years," considered fourteen feet "a good big shark." Veitch doubted any great whites were over eighteen feet (Matthiessen 1971).

If the megalodon was twice as big as Veitch's average, it would have been twenty-eight feet long. If it had been twice as big as Cousteau's large Azores, it would have been fifty feet. Ninety feet would have been an oversized estimate, even for 1972. Suggesting megalodon might have been longer than ninety feet, as Perry does, was just ridiculous.

The modern meg swam into popular culture in 1974 with the publication of Peter Benchley's popular *Jaws*. Benchley was deeply familiar with the *Blue Meridian* book, and it's no surprise to find *Jaws*'s ichthyologist Hooper paraphrasing Matthiessen and Clark: "What's to say megalodon is really extinct? Why should it be? Not lack of food. If there's enough down there to support whales, there's enough to support sharks that big." He cites Perry's dubious report of an

Australian shark that purportedly measured thirty-six feet, and he further paraphrases by suggesting that a megalodon could grow to a hundred feet. Hooper asks, "Can you imagine what a hundred-foot white would look like?" only to provide a strangely underwhelming answer: "It would be like a locomotive with a mouth full of butcher knives." Quint, the hardheaded fisherman, thinks this theory is "bullshit" and a lot of "fairy tales" (Benchley 1974).

Given the popularity of *Jaws*, it is surprising that no one immediately wrote a story about a modern-day megalodon, because Benchley pretty much gave them the idea on a silver platter. It wasn't until 1981 that Robin Brown published a book titled *Megalodon* based on the premise that *Carcharadon megalodon* could still exist in the trench known as the Molakai Fracture Zone near the Hawaiian Islands. To provide scientific backing for this premise, Brown's heroes read from Perry's *The Unknown Ocean*, specifically regarding the claims of thirty-six-foot whites and ninety-foot megalodons (Brown 1981). The term *megalodon* was unfamiliar enough at this time that, two years later, the U.K. paperback edition was renamed *Shark!*

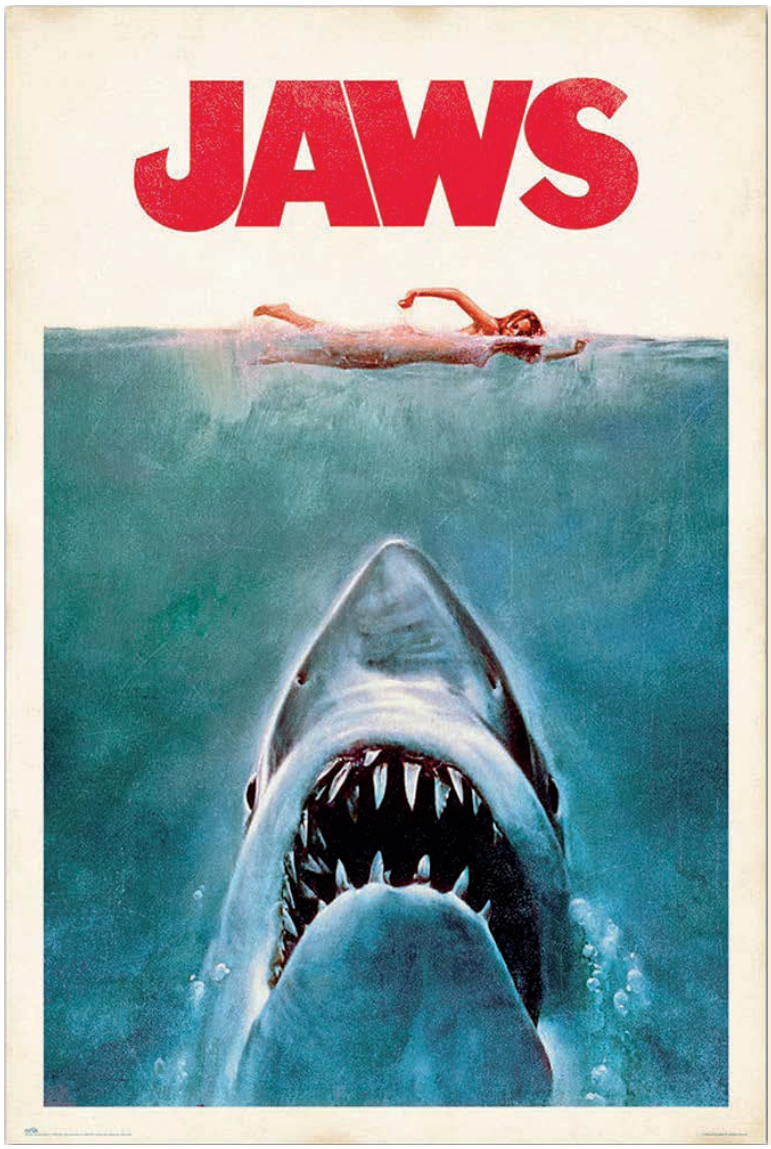
It seems likely Steve Alten took inspiration for his smash *Meg: A Novel of Deep Terror*, the basis for *The Meg*, from Brown's earlier book, because both *Meg* and *Megalodon* begin with a *megalodon* arousing suspicion with the destruction of a submarine, and both are rooted in Perry's theory that Pacific trenches would be appropriate dwelling places for latter-day megasharks. Meg has spawned seven literary sequels, including the upcoming *Meg:Purgatory*. Alten took Perry's theory and made a fortune off it.

Then came a slew of low budget movies with confusingly similar titles such as *Megalodon* and *Shark Attack 3: Megalodon*. Discovery Channel aired *Megalodon: The Monster Shark That Lives* and its follow-up *Megalodon: The New Evidence*. Aired in 2013 and 2014, these two shows were the low point in the cable station's long-running Shark Week lineup.

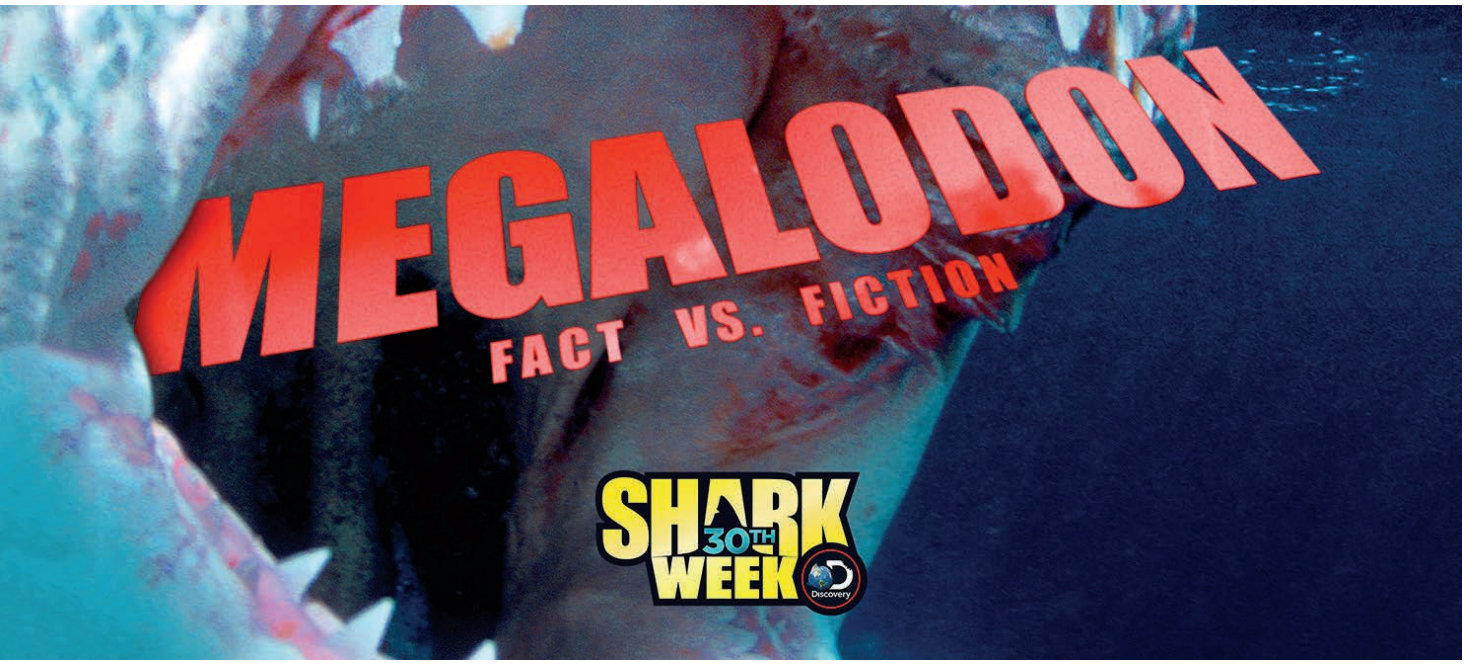
Discover magazine—no relation to the Discovery Channel or its parent company, Discovery Communications—ran an open letter accusing the channel of "peddling lies and fake stories." Written by Christie Wilcox, the heartfelt tone of the letter is pointedly summarized in this paragraph:

> Here's what I don't get, Discovery: Megalodons were real, incredible, fascinating sharks. There's a ton of actual science about them that is well worth a two-hour special. We've discovered their nursery grounds off the coast of Panama, for example. Their bite is thought to be the strongest of all time—strong enough to *smash an automobile*—beating out even the most monstrous dinosaurs. The real science of these animals should have been more than enough to inspire Discovery Channel viewers. But it's as if you don't care anymore about presenting the truth or reality. You chose, instead, to mislead your viewers with 120 minutes of bullshit. And the sad part is, you are so well trusted by your audience that you actually convinced them: according to your poll, upwards of 70% of your viewing public fell for the ruse and now believes that Megalodon isn't extinct. (Wilcox 2013)

Kyle Gardner, in association with the activist group Change.org, circulated a petition to Discovery Communications accusing the Discovery Channel of "airing fake documentaries and knowingly fooling people into believing lies about the natural world." It is a sad testimony to the popularity of hokum over fact to note that the Discovery "documentary" drew five million viewers while Gardner's petition was signed by only 160 supporters (Gardner 2014). Yet the bad press eventually got to the Discovery Channel. In 2015, they announced that Shark Week would be "more science and research focused." The 2015 special *Megalodon: Fact vs. Fiction* addressed the whole controversy in a would-be humorous fashion. Discovery's Vice President of Development and Production Joseph Schneier defended the earlier fiasco by saying that it "sparked a lot of interest" in the prehistoric sharks and showed the masses how "cool" they were (Yahr 2018).



Perhaps the Discovery Channel's executives have learned a lesson, but others haven't. In 2016, a video hit the internet and promptly received over a half million views. The shark in the video was a Pacific sleeper shark, or mud shark. Buzz Channel, which posted the footage, attempted to transform this mud shark into a megalodon by claiming that the small bait cage in the video was a shark cage (i.e., a much larger cage),



transforming a humble sleeper shark, no more than twenty feet in length, into a megalodon of approximately fifty feet. They also claimed the footage was taken in the fabled Mariana Trench. In fact, the video was old 2008 footage from Suruga Bay, in Japan (Keartes 2016).

Promoting the film adaptation of *The Meg*, Steve Alten appeared on George Noory's popular *Coast to Coast AM* radio show. Alten's main concern seemed to be settling an old score with a critic who'd claimed the book's theories were "nonsense." "Never mind that I wrote fiction," Alten groused. Though Alten preferred not to name his meddlesome opponent, Noory identified the critic as author and marine biologist Richard Ellis. Elsewhere, Alten seemed to agree with a caller that megs might still be around, though he didn't push the theory too strongly. It was pretty clear that Alten is no shark expert when he agreed with the old debunked canard that sharks don't get cancer (at one point turned into a book of the same name) and seemed unsure how to answer a question about megalodon longevity (Noory 2018).

Jon Turteltaub, who directed *The Meg*, didn't waste any breath trying to bolster the myth of a modern megalodon. He pretty much shot down Alten's trench scenarios by stating that "megs probably didn't live in the deep." Turteltaub gave audiences more credit than Alten and the Discovery Channel did by saying that for most viewers "the [giant] shark seems like fiction" (Cairns 2018).

If megalodon never died out, why have we not found more recent fossils? In its day, the megalodon had a wide distribution. A living megalodon would be a thrilling discovery. But the megalodon went extinct over two million years ago. Any anecdotal account of a modern sighting is probably just that: a fish story. ■

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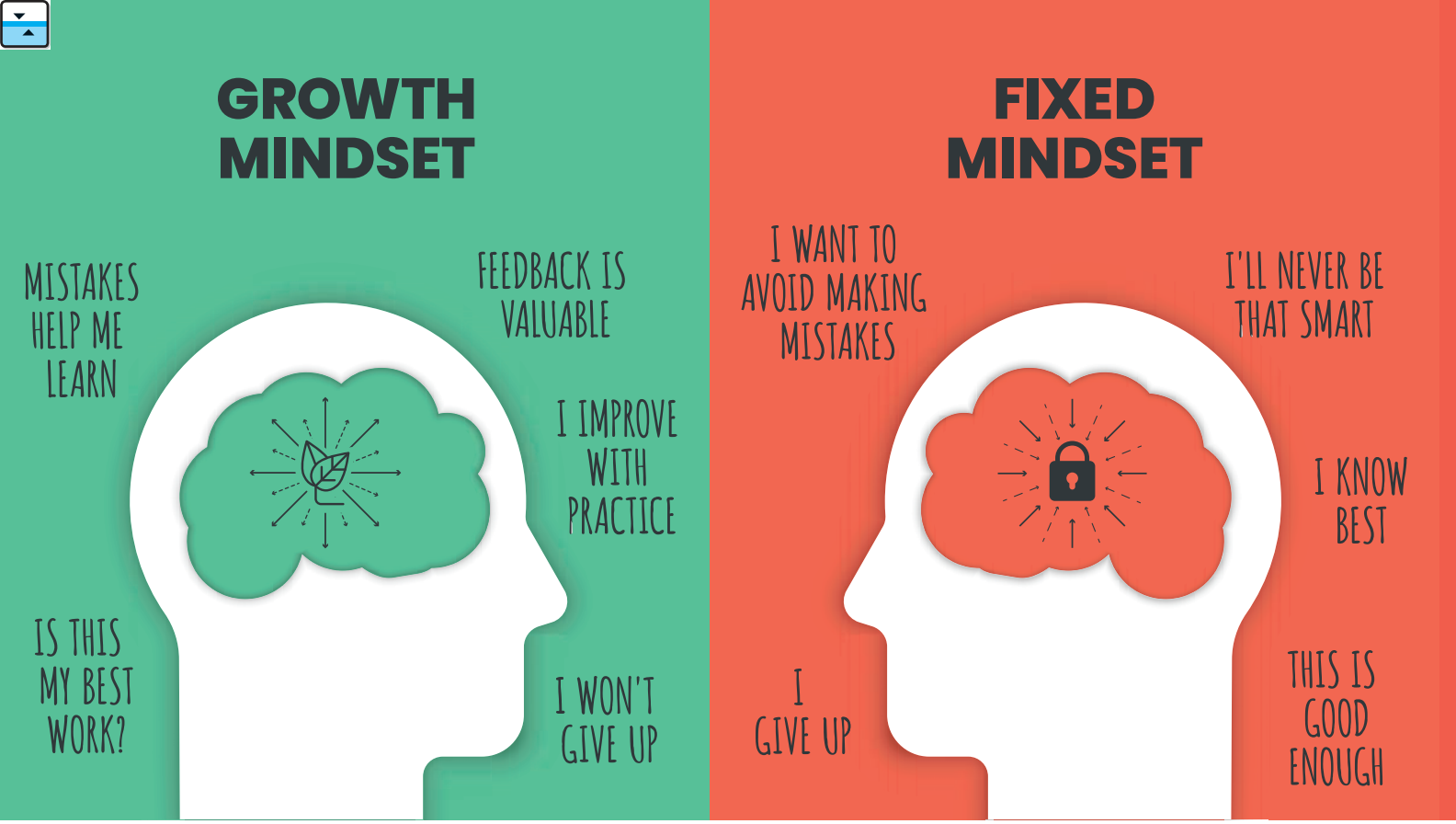

Should Schools Dedicate Time to Grit and Growth Mindset?

KATHARINE BEALS

Besides the pandemic's academic toll—seen, for example, in math and reading scores that have dropped to the lowest levels in decades (Mervosh 2022; Goldstein 2023)—there's also the psychological toll. Surveys suggest that high numbers of students are anxious and depressed and that many have fallen behind in emotional development (see, e.g., Miller and Pallaro 2022; Richtel 2022; Watts and Pattnaik 2023). This has prompted calls for schools to prioritize psychological health (e.g., St. George and Strauss 2022). The implicit assumption: students can't learn until certain social-emotional challenges are mitigated. Or, in its more positive formulation, enhancing students' social-emotional mindsets enhances their learning.

In a culture that has long prioritized psychological health and emotional intelligence over academic achievement, this last notion predates COVID-19 lockdowns by decades. Its latest incarnations date back to the early 2000s to two influential psychologists, Angela Duckworth and Carol Dweck. Duckworth and Dweck are known, respectively, as the originators of the psychological constructs *grit*, defined as "passion and perseverance for long-term goals," and *growth mindset*, defined as the belief that one's abilities are malleable and can be altered through hard work (Duckworth et al. 2007; Dweck 2006). Duckworth has inspired schools to devote class time to grit development and Dweck to growth mindset (Barshay 2019; Chen 2014; Fiorillo 2013; Hendrick 2019).

No one disputes that social-emotional factors affect academic achievement. At their extremes, stress, anxiety, trauma, sleep deprivation, brooding, and depression can make learning difficult or impossible. Nor is it surprising that both grit and growth mindsets are associated with positive outcomes. After all, hard work, perseverance, and confidence naturally boost achievement, and each of these is a component of either grit or growth mindset, as conceived by their respective originators and advocates.

The question, though, is whether and to what extent

schools should spend time on these social-emotional skills instead of on academics. The answer to this question depends on the answers to several others.

First, there's the question of learnability. To what degree are grit and growth mindset skills that people can acquire and/or improve upon, as opposed to being innate dispositions whose strengths and trajectories in different individuals are largely predetermined at birth?

Second, there's the question of teachability. Assuming that grit and growth mindset are learnable, to what extent are they skills that—like decoding words or adding numbers—can be acquired through targeted interventions rather than skills that can only be mastered implicitly from the environment, such as riding a bike or interacting with other people?

Third, to the extent that grit and growth mindset are indeed teachable, are schools adequately equipped to teach them? Do classroom teachers and/or school psychologists, for example, have (or have access to) the necessary training and teaching materials? Is there enough staff to give all students the instructional time they need?

Fourth, assuming that grit and growth mindset can be taught in schools, to what extent does this lead to demonstrable enhancements in academic achievement?

Fifth, assuming that grit and growth mindset can be taught in schools and do enhance academic achievement, is the time spent teaching them worth the opportunity costs? That is, to what extent is time dedicated to the development of these social-emotional skills more effective in enhancing academic achievement than equivalent time on academics or other social-emotional skills?

Sixth, might the causality (either additionally or instead) run in the opposite direction? After all, we know that academic success—indeed, success in general—can enhance confidence and perseverance. Given this, might there be additional opportunity costs to time spent on these social-emotional skills? Might equivalent time dedicated to academics do more to boost grit and/or growth mindset?

In the past decade, answers to some of these questions have started emerging, and those answers have not been favorable to fans of school-based grit and growth mindset programs.

The most long-standing issues concern grit. Almost from the moment that Duckworth proposed it as a novel factor in academic success (Duckworth et al. 2007), many people, including Duckworth's psychology colleagues, started asking questions. For example, do Duckworth's claims add anything to age-old observations about the importance of perseverance and conscientiousness? Conscientiousness, as it turns out, is highly correlated with grit, and perseverance, as it turns out, is the facet of grit most relevant to academic achievement (Credé et al. 2017; Kaufman 2016). As for teachability, only one paper, a working paper with Duckworth as a coauthor, appears to have assessed whether grit is teachable (Santos et al. 2021). It did so by examining the efficacy of an intervention designed to foster grit and self-regulation in sixth- and seventh-grade students in North Macedonia. The positive efficacy results it reports come from a single subjective measure: self-ratings by students on Duckworth's *Short Grit Scale*, an eight-item Likert scale survey that includes such items as "New ideas and projects sometimes distract me from previous ones." As to the influence of grit-teaching programs on academic performance, Credé et al. concluded from their meta-analysis of seventy-three studies that "interventions designed to enhance grit may only have weak effects on performance and success" (492).

What about school-based growth mindset programs? Here, too, a meta-analysis casts doubt. Analyzing sixty-three studies, Brooke Macnamara and Alexander Burgoyne (2022) found that studies whose authors include people with incentives to report positive effects (for example Dweck, who not only originated the concept but regularly promotes it) were significantly more likely to report positive effects. They also found that only twenty-five of the studies showed measurable positive changes in students' mindsets. In those studies, moreover, there were no significant differences in academic achievement between students who received growth mindset interventions and control groups. In line with what Credé et al. concluded about grit, Macnamara and Burgoyne concluded that "studies adhering to best practices are unlikely to demonstrate that growth mindset interventions benefit students' academic achievement" (163).

What about the other direction of causality—the possibil-

ity that academic engagement and achievement could boost social-emotional skills? Potentially, the more engaging the academic material, the more it transports students from potential sources of anxiety; the more success they have with it, the more confident they feel; and the more their effort yields not just success but cumulative progress, the more motivated they are to sustain that effort even when the going gets tough.

Given this, if our goal is to improve social-emotional *and* academic skills, the academic approach may be more promising than the social-emotional approach. In contrast to the minimal and questionable evidence that schools can teach grit and growth mindset, the evidence that (at least some) schools can teach academic skills has been accumulating for centuries. But what does the latest research tell us about the academics-to-mindsets direction of causality? Not nearly as much research has explored this direction of causality as has explored its opposite, and little if any published research explores the effects of academic achievement on the grit and/or growth mindset in particular.

One study, however, looked at other psychological effects (Morgan et al. 2012). Focusing on math skills in third grade and social and emotional characteristics in fifth grade, Paul Morgan et al. found that poor reading skills predict subsequent anger, distractibility, sadness, loneliness, and unpopularity—characteristics that describe about 20 percent of the struggling readers. Poor math skills, meanwhile, predict subsequent sadness and loneliness. More recently, Pedro Dias et al. (2022) reviewed several (mostly European) studies, as well as conducted their own study of students in Portugal, and found a causal relationship between academic achievement and both depressive symptoms and behavioral problems. Dias et al.'s conclusion: "Success in learning is central in children and adolescents' psychological functioning" (1193).

Findings like these provide a different perspective on the COVID-19 pandemic, academic test scores, and reports of depression and anxiety in our students. Besides physically isolating students from their peers, COVID-19 lockdowns reduced their academic engagement. Online learning proved to be vastly inferior to in-person learning (see, for example, Cortés-Albornoz et al. 2023), and many students checked out even if their faces—rather than their avatars—remained in the grid.

What all this suggests is that the most effective school-based remedy for that which most afflicts America's ailing school children may be something that flies far below the radar of many well-meaning advocates and far below those lofty goals of promoters of grit and growth mindset programs: namely a rededication to providing systematic, nuts-and-bolts research–based instruction. ■

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Serpopards or Sauropods? 'Dead Varmint Vision' Makes Cats Look Like Dinosaurs

According to recent anti-evolution propaganda, certain long-necked creatures (serpopards) in ancient Egyptian and Mesopotamian art are sauropod dinosaurs. These so-called "dinosaurs" are instead cats with exaggerated necks viewed through dinosaur-colored glasses.

PHILIP J. SENTER

Archaeologists use the term *serpopard* to denote a cat with an exaggerated neck, a motif that appears occasionally on ancient Sumerian and Egyptian artifacts. The term combines the words *serpent* and *leopard*. The former is a reference to the snake-like neck, and the latter acknowledges that apart from the neck, the animal is one of the big cats. It doesn't have a mane, so it is not a male lion, but it could be meant as a lioness. The significance of the elongated necks in these feline images is currently a mystery.

Serpopard images first enter the known archaeological record in the late fourth millennium BCE, on cylinder seals from the Sumerian city of Uruk (Moortgat 1935, 77–85). The most famous of these is one in the Louvre, which shows a series of pairs of serpopards with intertwined necks (Figure 1). Serpopards subsequently appear on Egyptian cosmetic palettes of the thirty-first century BCE, from the city of Nekhen (also known by its Greek name Hierakonpolis) in Upper Egypt (Quibell 1900; Quibell and Green 1902), including the Narmer Palette and the Two Dogs Palette (Figure 2). Serpopards then vanish from the known archaeological record for over a thousand years and reappear in the tomb of Ukhhotep II, an Egyptian official of the twentieth century BCE, who oversaw the city of Cusae. In the writing within his tomb, the hieroglyph that represents the name of Cusae is a male human figure standing on the backs of a pair of serpopards and holding their throats (Blackman 1915, 31, pl. XVII). Serpopards subsequently make appearances as protective figures on several Egyptian hippo tusk wands of the nineteenth and eighteenth centuries BCE, carved amid other protective figures (Figure 3). Attending nurses used these wands to ward off evil during royal births (Quirke 2016, 392–394, 573–594).

Serpopards are clearly cats, but anti-evolution authors seem to have difficulty seeing them as such. Such authors frequently misidentify serpopards as sauropods, the herbivorous dinosaurs with long necks and tiny heads that include such familiar examples as *Apatosaurus*, *Brontosaurus* (once thought to be synonymous with *Apatosaurus* but now thought to be distinct; see Tschopp et al. 2015), *Diplodocus*, and *Brachiosaurus*. A few authors misidentify serpopards as *Tanystropheus*, a long-necked, non-dinosaurian reptile of the Triassic Period. These misidentifications are manifestations of the strong tendency among anti-evolution authors to see dinosaurs and other prehistoric animals where there aren't any in ancient and medieval art. This tendency has been dubbed "dead varmint vision" (Senter 2013a). It is a frequent contributor to the so-called "evidence" that young-earth creationist (YEC) authors cite in support of their position: that God created the world about 6,000 years ago and created each kind of animal separately, as described in Genesis. YEC authors under the influence of dead varmint vision have misidentified numerous

Figure 1. Serpopards on an impression of a cylinder seal from Uruk, currently housed in the Louvre. The photo on the left shows the artifact as it is. In the picture on the right, I have digitally removed the necks of two serpopards. Note that once their long necks are removed, what's left is a pair of cats. This illustration and those in Figures 2 through 4 are from ***The Real Story of Dinosaurs and Dragons*** (Senter 2024) and are reproduced here with kind permission from Feral House. The left photo in this figure is originally from Delaporte (1920, pl. 64 fig. 9).

Figure 2. Serpopards on cosmetic palettes from the ancient Egyptian city of Nekhen (Hierakonpolis). A. The Narmer Palette. B. The Two Dogs Palette. The photos on the left show the artifacts as they are. In the pictures on the right, I have digitally removed the necks of the serpopards. Note that once their long necks are removed, what's left is a pair of cats. The left photo in A is originally from Quibell (1900, pl. XXIX). The left photo in B is originally from Quibell and Green (1902, pl. XXVIII).

animals in ancient and medieval art and literature as dinosaurs. Such animals include snakes, birds, lions, giraffes, and imaginary sea monsters (Senter 2012, 2013a, 2013b, 2018, 2019a, 2019b, 2024; Siebert 2013; Burnett 2019). YEC authors' search for dinosaurs in ancient art and literature is part of an effort to marshal "evidence" of human coexistence with dinosaurs, which is meant to cast doubt on the separation of humans and dinosaurs by millions of years, which in turn is meant to cast doubt upon the passage of millions of years. In the case under discussion here, the great power of the dinosaur-colored glasses of dead varmint vision to influence perception is beautifully illustrated by its having influenced intelligent people with doctoral degrees to see cats as dinosaurs.

"Looks like dinosaurs to me," says Kent Hovind (who holds a PhD in Christian education) of the serpopards in the Narmer Palette in a recording of a stage presentation in 1994, during which he also called the serpopards on the Two Dogs Palette "long-necked dinosaurs" and implied that a serpopard on a hippo tusk wand may have been another dinosaur (Hovind 1994). Brian Thomas (PhD in paleobiochemistry) mentioned the serpopards on the Narmer Palette and the Louvre cylinder seal during an interview published in 2010, saying that they "look just like" the illustrations of the sauropod dinosaur *Apatosaurus* in a children's book (Isaacs 2010). He also likened the Narmer Palette serpopards to sauropod dinosaurs in a book (Thomas 2013, 45–48) and likened the

Figure 3. Serpopards on ancient Egyptian wands of hippo tusk ivory. The photos on the left show the artifacts as they are. In the pictures on the right, I have digitally removed the necks of the serpopards. Note that once their long necks are removed, what's left is a pair of cats. The left photo above is of a wand on display at the Metropolitan Museum of Art in New York City. The left photo below is of a wand on display at the Walters Art Museum in Baltimore (photos by Philip J. Senter).

Narmer Palette and Louvre cylinder seal serpopards to dinosaurs in a stage presentation that was published on DVD in 2014 (Thomas 2014). James Gilmer (PhD in psychology) likened the Louvre cylinder seal serpopards to *Apatosaurus* in two books (Gilmer 2011, 101; Gilmer 2013, 95). Tim Clarey (PhD in geology) misidentified the Narmer Palette serpopards as sauropods in a book (Clarey 2015, 21). The animal depicted on the Louvre cylinder seal "unmistakenly [*sic*] resembles *Tanystropheus*," according to a book written by Jonathan Sarfati (PhD in chemistry) and Joel Tay (MDiv, M.Theol.) (Sarfati and Tay 2020, 212–213).

Other anti-evolution authors, when confronted with serpopards, have also fallen prey to the altered perception that dead varmint vision generates. Dominic Statham, an engineer, called the Narmer Palette serpopards "dinosaur-like creatures" and likened the Louvre cylinder seal serpopards to *Tanystropheus* and *Brachiosaurus* (Statham 2012). Dave Woetzel, a technology firm president, misidentified the Louvre cylinder seal serpopards as sauropods, called the Narmer Palette serpopards "long-necked dragons," called the Two Dogs Palette serpopards "'dinosaur-like' creatures," and recognized that a serpopard on an Egyptian hippo tusk wand was "a similar long-necked creature" (Woetzel 2012, 49). Author Russel Tingley also misidentified the Louvre cylinder seal serpopards as sauropods and called a serpopard on an ancient Egyptian palette a "sauropod-like animal" (Tingley 2015, 167–171). A book by the Institute for Creation Research likened the Narmer Palette serpopards to sauropods (Institute for Creation Research 2015, 25). The serpopards on the Louvre cylinder seal "are obviously sauropods … These look very much like the unmistakable *Tanystropheus*," according to a book written by meteorologist Michael Oard, former high school science teacher Tara Wolfe, and Gary Bates, CEO of Creation Ministries International (US) (Oard et al. 2016, 90)—even though *Tanystropheus* is not a sauropod.

Despite this plethora of opinions that serpopards are (or could be) sauropod dinosaurs, it is easy to demonstrate that a serpopard is a cat. Simply remove the long neck, and what's left is obviously feline (Figures 1–3). The head of a serpopard sports external ear flaps, a diagnostically mammalian trait, and they are often rounded like the ear flaps of lions and leopards. The snout bears a rhinarium, the hairless body of tissue around the nostrils that cats and many other mammals have, another diagnostically mammalian trait. The upper lip is often depicted with a rounded border, convex downward, like that of a cat. In some cases, the artist has added a feline ruff of cheek fur. The shoulder blade, when shown, is a broad, vertical oval (like that of a cat) and not an elongated, diagonal strap (like that of a sauropod). The animal's dorsal surface is convex in the shoulder area and concave between the shoulder and the hip, as in a cat, and unlike the dorsal surface of a sauropod, which is convex from shoulder to hip. The tail of a serpopard is of uniformly narrow diameter, with a rounded tip—as in a feline tail and unlike a sauropod's tail, which is thick at the base and tapers to a pointed tip. The limbs of a serpopard bear feline paws, and the artist sometimes adds a dewclaw, both of which features are absent from sauropod limbs. The rearward-pointing ankle of a serpopard, like that of a cat, is held high off the ground, unlike that of a sauropod, which is held off the ground at a low height (Figure 4). The only way to mistake a serpopard for anything but a cat is to fixate on its neck and ignore the rest of its body.

Could it be that a serpopard's resemblance to a cat is accidental and that a sauropod would look like a cat if its long neck were removed? It's easy enough to test that hypothesis. The experimental result is shown in Figure 4. Is it possible to mistake the neckless sauropod in that figure for a cat? Perhaps, but most people probably wouldn't.

The anti-corrective lenses of dead varmint vision cause one to see things as they aren't. This is a good reason not to don such glasses. Another good reason is that they are normally donned in the process of trying to defend a literal interpretation of Genesis as an accurate record of past events, whereas Genesis itself shows us that it is no such thing. It shows us this through anachronisms and internal contradictions, which I have listed elsewhere (Senter 2022, Tables 1 and 2) and in my new book *The Real Story of Dinosaurs and Dragons* (Senter 2024, ch. 10). The internal contradictions are glaring and cannot have been missed by the redactor(s) who pieced Genesis

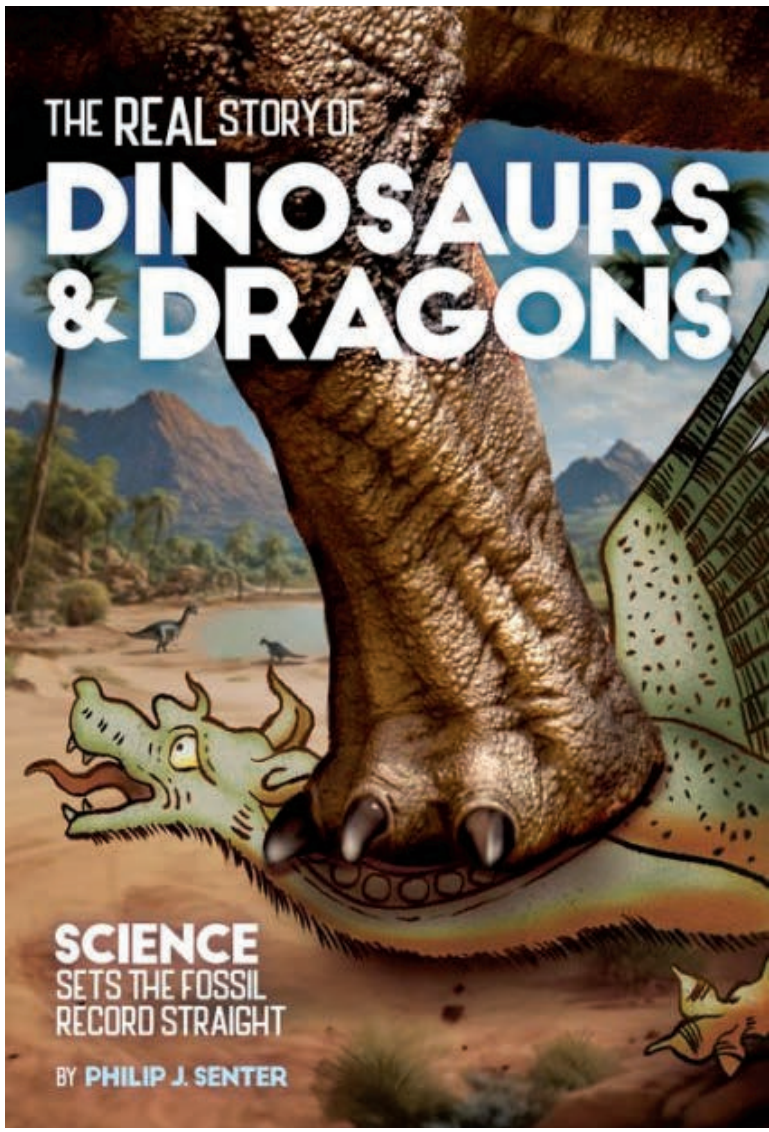

Figure 4. Sauropod dinosaurs: *Brontosaurus* and *Camarasaurus* skeletons at the Peabody Museum of Natural History (left) and a model of the sauropod dinosaur *Pleurocoelus* at the North Carolina Museum of Natural Sciences (right). The skeletons show that in sauropods, the dorsal surface of the back is convex, the shoulder blade is elongated and diagonal, the ankle is close to the ground, and the tail is thick at the base and tapers toward the tip. The two photos on the right show that with its neck digitally removed, as in the picture on the far right, a sauropod does not look like a cat (photo by Philip J. Senter).

together from its source documents. The redactor(s) therefore knew that several of the narratives within Genesis contradict each other, and yet left the contradictions there instead of making the book internally consistent by selectively deleting passages that contradict other passages. The most logical conclusion to draw from this is that the redactor(s) of Genesis did not mean for the narratives to be taken literally as accurate records of past events. Numerous passages within the Psalms, Prophets, and New Testament also attest that Genesis and the rest of the Pentateuch ought not to be taken literally as history (Senter 2022). Just as the ancient Greeks knew their myths were stories of things that hadn't happened (Blank 1998, 52; Trzaskoma et al. 2016, 89–91, 116–122, 288–298, 342–343), the ancient Hebrews knew that their sacred stories were expressions of theology in story form, not straightforward history (Senter 2022).

Because the Bible itself endorses a nonliteral interpretation of the Pentateuch, a truly Bible-based worldview is one in which Genesis is not taken literally as history. A true Bible believer is therefore free to accept such findings of science as evolution and the passage of millions of years, for which the empirical evidence is overwhelming (Prothero 2017; Strachan et al. 2020). These findings differ from the narratives in Genesis, but this is not a problem for the Bible believer, once they are aware that the Bible itself teaches that the Pentateuch's narratives are not meant to be taken literally as history. A corollary of this is that the YEC view is not consistent with a Bible-based worldview but instead contradicts it, despite that YEC advocates are (incorrectly) convinced that the YEC view is consistent with biblical teaching. This is an important thing for Bible believers to consider. A positive side effect of such consideration is that it eliminates the motivation to don the anti-corrective lenses of dead varmint vision. Once those dinosaur-colored glasses are removed, one can clearly see a cat as a cat. ■

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What We Do Wrong in Science Education and How We Should Do It Better

CARL WIEMAN

Most people who have taken a college science course are familiar with the prevailing method of teaching science, a method that has existed for decades if not centuries. The predominant contact between student and teacher is the student sitting listening while the teacher lectures. The lectures are mostly telling information and procedures. The student might be taking notes, although in the modern classroom they are more likely to be checking their phones, surfing the internet, or dozing off. After the lecture, the students then do homework problems and take exams that involve memorizing and applying the facts and procedures from the lecture and textbook. The goal of these problems is for the students to produce the specific solution method the instructor had in mind.

Modern research on teaching and learning science, mostly at the college level, is revealing many things wrong with traditional teaching and how to do it better. The most fundamental insight is that true learning is not a process of filling up a fixed brain with knowledge but rather involves brain development. In a good education, the neurons are connected differently, rewired essentially, in response to intense thinking, and this rewired brain has new capabilities. Achieving this brain development requires strenuous and appropriate mental exercise.

Although these conclusions are supported by extensive careful research, the basic findings are easy to observe in a common experience. Think about learning to find your way around a strange city. If you always simply follow the GPS directions about where to turn when driving between different locations, you end up knowing very little about the layout of the city. To develop a meaningful understanding of the city layout, you need to instead be confronted with decisions on how to go from one location to another, practice making those decisions, and then see what works. Then, when the choice of route is wrong, you need to recognize *how* it is wrong and how to choose a better route.

Learning science is quite similar, and this example reveals the shortcomings of traditional instruction. During the lecture, the instructor is telling students the equivalent of the GPS directions. They are told facts and solution procedures to memorize and repeat if the particular situation arises, but there is no processing of the ideas as needed to develop the brain and achieve true learning. They never practice making decisions and figuring things out. So, the students may at best learn knowledge, but they do not learn when and how to use that knowledge when confronted with novel problems; they get what's called *inert knowledge*. The existence of such inert knowledge has been supported by many studies of learning in traditional science courses.

However, research reveals other weaknesses of traditional instruction. These include the amount of new information in a typical lecture. Studies show that the number of new ideas the human brain can pay attention to and keep track of in a short time is very limited, around five to seven. This limit is vastly exceeded by the amount of new terminology and information presented in a typical lecture, so no student brain can possibly process and absorb all that material. Another weakness is that students are primarily taught and tested on reproducing the precise answer or solution the instructor wants to see. However, all the important problems a student will encounter in the real world do not require routine, well-established solutions. Computers have been taught to solve all those kinds of problems. Authentic problems—where human brain power is important—involve solving novel problems and require novel creative solutions, not just solutions that people have already thought of (and that are in common use). But the latter is just the kind of routine problem solutions students are being taught. One might think of this as teaching them to be "anti-creative" in their problem solving.

The good news is that research has shown much more effective ways to teach, although it is not widely practiced. These methods involve having the students spend class time actively thinking, solving problems, making decisions, and "figuring things out." Students learn to recognize and use the relevant information to make decisions. These tasks have students practice "thinking like a scientist," which is the requisite mental exercise needed to suitably develop their brains. To optimize learning, as they carry out this thinking practice, they need good feedback that is timely and actionable to help them improve. The best feedback is not to just give the answer but rather to help the student recognize where their thinking is wrong and how to improve it.

How does one do this kind of teaching in an actual class?

I can describe this in the context of a class that was part of an experiment to compare research-based teaching with conventional lecture (Deslauriers et al. 2011). In this experiment, two sections of a large introductory physics class (with nearly identical student populations) were taught with different methods for one week. One section was taught by a very experienced and highly rated professor using a traditional lecture approach. The other section was taught by a young instructor trained in research-based teaching methods in the program I ran. The two instructors agreed to cover the same topics in the same amount of time and then give the students a jointly developed quiz to test their learning. The research-based class had many fairly standard features of research-based instruction. The students had a short pre-class reading assignment that gave them some basic information to prepare for class. In class, they were given questions and problems to solve. Some of these were multiple choice questions on basic conceptual points that they would answer using electronic devices. The instructor's computer would record the student's identity and what they selected and could display the overall choices of the entire class. After the first vote, the students were not told the answer; instead they were told to discuss with their neighbors and then revote (i.e., "peer instruction"; Mazur 1997). While the students were having discussion, the instructor would go up and down the aisles listening to the student conversations to get insights into their thinking. After the second vote, the instructor would lead a whole class discussion giving feedback on which answers were correct and, more importantly, which answers were wrong and why. For more mathematical questions, students would have worksheets where they would write out solutions, again in collaboration with neighboring students while being monitored by the instructor. Feedback was provided. After one week of instruction, the two sections were given a surprise quiz. The two distributions of results were dramatically different, with the research-based section learning nearly twice as much.

There have now been many hundreds of studies comparing traditional lecture instruction with research-based "active learning" across many different fields of science and course levels. The research-based instruction consistently shows greater learning and lower failure rates (Freeman et al. 2014).

In much research-based teaching, the focus has been on students working in small groups to complete worksheets of various types. A particularly useful type has them practice making the particular problem-solving decisions that are involved in solving nearly any authentic science problem (Price et al. 2021). The completion of the worksheets is always followed by instructor feedback and answering questions, thus providing the students with the mental exercise of practicing the thinking processes of scientists accompanied by guiding feedback from their fellow students and the instructor.

Research in science education has shown that multiple factors are important to optimize learning. This is too extensive to cover here beyond a very brief survey. The design of the practice problems for the students needs to call upon the appropriate subject matter knowledge, be matched to the students' backgrounds so the tasks are challenging but doable, motivate the students to put in the hard mental effort required for good learning, and limit the amount of new information to a level the brain can handle. Research has also shown best practices for implementing these exercises in the classroom, including having clear deliverables and feedback to the students and having suitable structuring and guidance to the student groups to optimize the social learning that takes place. How well a teacher knows about and applies this body of research is a good measure of their expertise as a science teacher. Hopefully, we will see far more college teachers with such expertise in the future. ■

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Combating Misinformation with Psychological Science

DAVID G. MYERS, C. NATHAN DEWALL, AND JUNE GRUBER

Editor's note: This article is an excerpt from Exploring Psychology 13e *(in press). Author of several best-selling textbooks, David Myers has subscribed to SI from the beginning, often citing our articles. Thank you to the authors, Worth Publisher, and Macmillan Learning for granting permission.*

Consider examples of misleading misinformation (whether intended or not) and of intentionally false *dis*information:

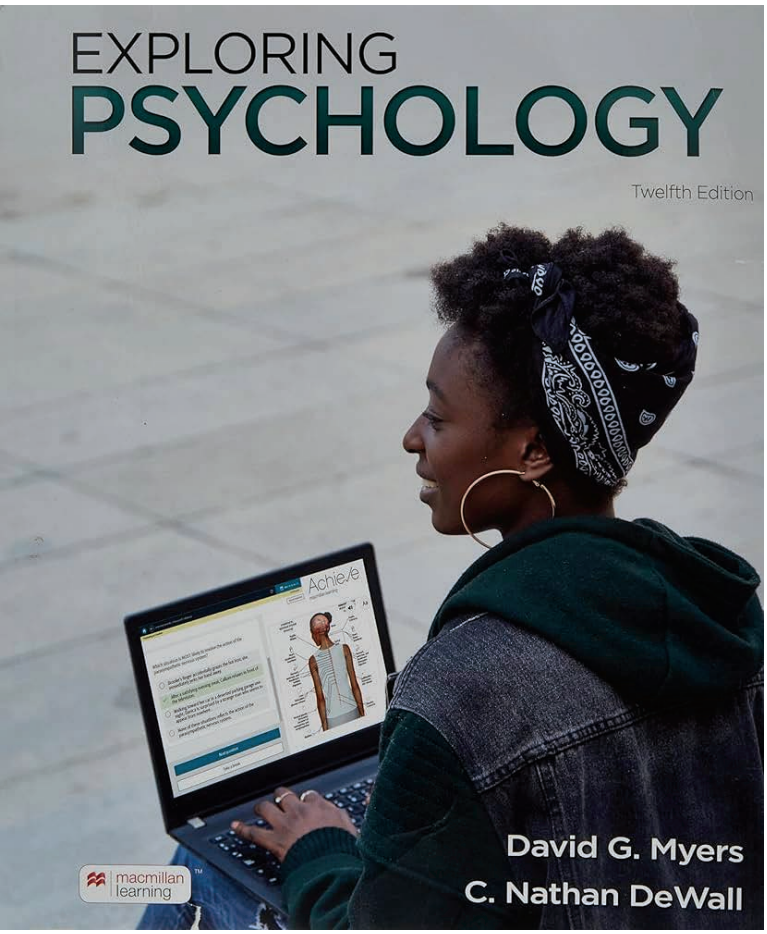
- *Misinformation makes us fear the wrong things.* Nearly every year from 1992 to 2022 — an era of *less* crime — seven in ten Americans, told Gallup that, compared with a year ago, there was *more* crime (Brennan 2022). Nearly half of Americans have expressed the belief that immigrants worsen "the crime situation," despite immigrants being imprisoned *less* than native-born Americans (Flagg 2018, 2019; Gallup 2023).
- *Misinformation kills.* Worldwide, adults sixty-five years and older feared COVID-19's initial spread no more than did younger adults, though it was more likely to kill them (Rothwell 2020). Moreover, vaccine misinformation mattered: Compared with those of their age who were fully vaccinated against COVID-19, those unvaccinated or not fully vaccinated feared COVID-19 *less* but were much *more* likely to die of it (Giattino et al. 2023; Ward 2021).
- *Misinformation rationalizes war.* A reported two-thirds of Russians approved of Vladimir Putin's invasion of Ukraine in 2022, which he claimed was a peacekeeping operation to liberate Ukrainian Russians from Nazi oppressors (Dickinson 2022). (Ukraine, a democracy, has a Jewish president whose relatives died in the Nazi Holocaust.) In 2003, after persuading most Americans that Iraq had weapons of mass destruction, the United States invaded Iraq (Doherty and Kiley 2023). (The U.N. weapons inspector found none.)
- *Misinformation fuels conspiracy theories.* Millions of people have been persuaded of evil secret plots — that their country is ruled by Satan-worshiping pedophiles, that vaccines have embedded microchips, or that an election was stolen via dead peoples' voting. Some even believe that the 9/11 terrorist attacks or the Sandy Hook school massacre were hoaxes. The result: fiercely divided voters, public outrage, and domestic terrorism (Sternisko et al. 2020).

Although conspiracy theories and anti-science views have been associated with the political right (Baron and Jost 2019), extreme liberals and conservatives both exhibit greater-than-average dogmatism and susceptibility to conspiracy theories (Enders et al. 2022; Harris and Van Bavel 2021; Zmigrod et al. 2020). And more mundane misinformation is common among less extreme people as well. In the United States, for example, most Republicans believed unemployment increased under Democratic President Barack Obama (it decreased), while most strongly identified Democrats believed inflation worsened under Republican President Ronald Reagan (it improved; Gelman 2009; PPP 2016). Indeed, reported psychologist Peter Ditto and his colleagues (2019a, 2019b), partisan bias affects both liberals and conservatives, "and at virtually identical levels." So, bias goes both ways. Yet leaders from both parties have bemoaned rampant misinformation. The late Republican Senator John McCain (2017) lamented "the growing inability, and even unwillingness, to separate truth from lies." Former U.S. President Barack Obama (2022) concurred, noting that one "of the biggest reasons for democracies weakening is the profound change that's taking place in how we communicate and consume information." Agreement across partisan divides requires, first, a shared understanding of the essential facts.

Why Do People Succumb to Misinformation?

Why do people so readily come to believe what isn't so? Several psychological phenomena — to be explored further in other modules [in *Exploring Psychology 13e*] — give us clues.

FAKE NEWS FLIES. As Jonathan Swift anticipated in 1710, "Falsehood flies, and the Truth comes limping after it." In one analysis of 126,000 stories tweeted by three million people, falsehoods, especially fake political news, spread "significantly farther, faster, deeper, and more broadly than the truth" (Vosoughi et al. 2018). This effect is particularly



Previous edition of Exploring Psychology (the forthcoming edition is coming soon).

problematic when it comes to *disinformation* — fake news that is deliberately planted and spread.

OUR DEFAULT SETTING IS TO BELIEVE WHAT OTHERS SAY. We're naturally disposed to believe others, which is an inclination that psychologists call our "truth bias" (Pantazi et al. 2018). Mostly, other people are useful information sources. But not always. Scammers deceive. Schemers mislead. As detective Miss Marple observed in Agatha Christie's *A Murder Is Announced*, "People I find are apt to be far too trustful."

REPETITION BREEDS BELIEF. In experiments, statements become more credible when repeated. What people hear over and over, whether true or false, gets remembered and comes to seem true (Fazio et al. 2015, 2019; Fazio and Sherry 2020). Even implausible statements—"Elephants run faster than cheetahs"—become more plausible with repetition (Lacassagne et al. 2022). Adolf Hitler (1926) understood this, noting "All effective propaganda must be limited to a very few points and must harp on these in slogans." After many repetitions, even a lie can seem like a truth. What's familiar feels factual.

VIVID EXAMPLES STAY MENTALLY AVAILABLE IN OUR MIND. A mass killing, a horrific murder, or a plane crash leads the news with vivid images that stay readily available in our memory. Journalists joke, "We don't cover the planes that land." Small wonder that people greatly overestimate their risk of victimization by terrorism, crime, and plane crashes.

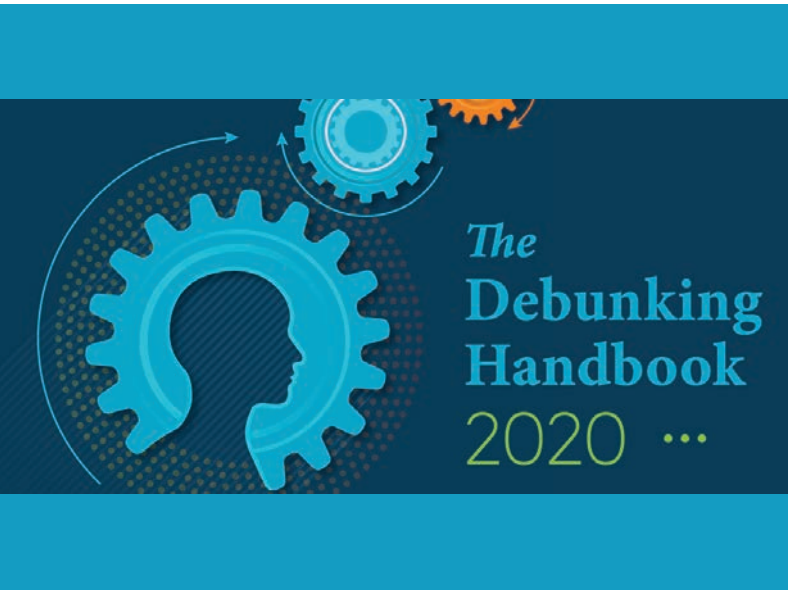
WE ARE MOTIVATED TO CONFIRM OUR OWN BELIEFS. People tend to feel overconfident in their own intuitive judgments and to resist correction. *Motivated reasoning* leads people to perceive things the way they want to. *Confirmation bias* inclines people to expose themselves only to news commentary, social media, and websites that support their views. Moreover, the less expertise people have in a specific area, the more likely they are to overrate their knowledge. As the fictional Doctor Who observed, "The very powerful and the very stupid have one thing in common. They don't alter their views to fit the facts. They alter the facts to fit their views."

ECHO CHAMBERS POLARIZE OPINIONS. People seek out and befriend those who reinforce what they already think, creating an "echo chamber" of their opinions (Crockett 2017). We tend to live among like-minded neighbors (Brown and Enos 2021). On social media, we tend to friend and follow people who think as we do (Cinelli et al. 2021). Social media exchanges among like-minded people will often amplify attitudes and inflammatory emotions (Haidt and Bail 2023). Insults exceed insights. Thus, in the United States, the percentage of Democrats and Republicans who regarded those in the other party as "dishonest" and "immoral" jumped from about four in ten in 2016 to near seven in ten in 2022 (Pew 2022).

How Not to Drown in the Misinformation Sea: Keeping Truth Afloat with Psychological Science

If we find ourselves facing a firehose of falsehoods, we can resist. We can remember that most of us misperceive ourselves as (compared to others) invulnerable (Chen et al. 2023). We can filter the spray of incoming information with critical thinking and a scientific mindset. We can be wary of the persuasive power of repetition, vivid but misleading anecdotes, motivated reasoning, and like-minded polarization. We can winnow evidence with open-minded curiosity, skepticism, and humility. And we can assist others by *debunking* and *prebunking* falsehoods.

DEBUNKING. Imagine that a friend or classmate worries that, as one myth asserts, vaccines cause autism. Imagine also that you know better—that this falsehood stems from a fraudulent study and that research consistently finds that vaccinated children are *not* more likely to be diagnosed on the autism spectrum (DeStefano and Shimabukuro 2019). Should you rebut the claim with evidence? Or would that backfire, causing your defensive friend to believe the myth more strongly?



Experiments indicate that your effort to debunk, if done smartly, will help more than hurt, especially when it communicates a scientific consensus (Schmid and Betsch 2019; van Stekelenburg et al. 2023). Start with a spirit of kindness by showing respect and empathy for the person's intentions and worldview. Ask about the source for the belief. In *The Debunking Handbook* (2020), psychologist Stephan Lewandowsky and colleagues further advise four steps:

- *Fact.* Lead with a clear, simple assertion, such as "In several studies, childhood vaccinations were found to be safe and protective."
- *Myth.* Acknowledge the belief: "Some people do worry that the MMR vaccine increases the likelihood of childhood autism."
- *Fallacy.* Explain why that is misinformation: "A British study of 12 children made the claim, but was exposed as fraudulent, and the journal retracted the study."
- *Fact.* Restate, and leave people with the truth: "Most children get vaccines, and, of course, some children are diagnosed on the autism spectrum. But a dozen studies all have found no connection between vaccines, or their ingredients, and autism in children."

PREBUNKING. Debunking won't always be persuasive. Misinformation, once implanted, can be hard to erase. But as in medicine, prevention is better than cure. So an even better strategy is to *prebunk*—to inoculate and protect people from likely future misinformation (van der Linden 2022; 2023). Preemptively forewarn people about manipulative techniques, about deepfake digital images and videos, or about a falsehood, and equip them with pertinent evidence. Much like a medical inoculation (a weakened virus) activates our body's defenses to prepare for a full-blown virus, such misinformation "vaccines" can prepare us to resist untruths.

Google has experimented with prebunking by offering internet videos that teach people "how to spot false claims before they encounter them" (Klepper 2023). In Europe, for example, they prebunked misinformation about the Ukrainian war and its refugees. Another effective prebunking strategy is to create and share a visual replica of a deceptive message, with an embedded debunking message known as a "poison parasite." That way, the next time people view the deceptive message, it will also remind them of the associated counterargument. In seven experiments, counterarguments to misinformation were more effective when associated with the deceptive communication (Cialdini et al. 2021).

Some educational programs also engage students with games in which they simulate disinformation tactics by creating fake experts, arousing fear, and spreading conspiracy theories, and later helping them spot such in social media (Sleek 2022). Forewarned can be forearmed.

The good news is that we can build a real-truth world by embracing a scientific mindset. Mindful of our own biases, we can listen and learn. Confronted with an opposing view, we can discuss before we dismiss. And with a mix of curiosity, skepticism, and humility, we can adopt the spirit of critical thinking: To accept everything is to be gullible; to deny everything is to be a cynic. ■

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Note

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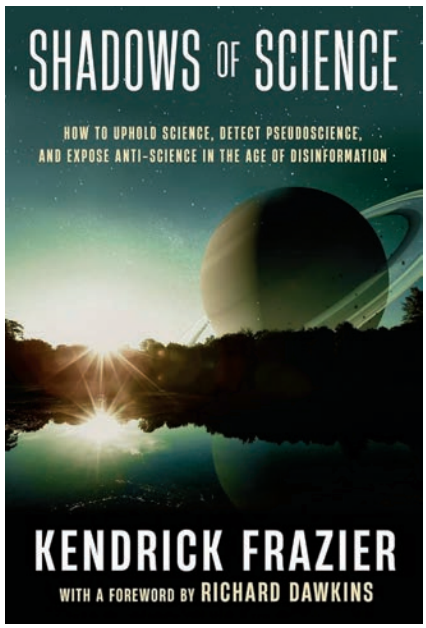
Kendrick Frazier's Farewell

Terence Hines

Kendrick Frazier, the longtime editor of this magazine, has written an excellent book on pseudoscience as it contrasts with real science. The book is different from others in that it does not emphasize detailed descriptions of studies showing that this, that, or the other pseudoscience is bogus. Oh, there are references to be sure, but the emphasis is much more on explaining what science is, how it works, and how it differs from pseudoscience. The examples are clear and sometimes a bit surprising. The writing is compelling and frequently includes personal observations and experiences. The latter makes the book feel like a personal communication from Frazier. This is a book aimed at the proverbial intelligent "person on the street" who isn't looking for descriptions of study after study but logical discussions of what pseudoscience is and why it is dangerous.

In the first chapter, "Science and the Frontiers of Discovery," the contrast between real science and pseudoscience revolves around the fact that real science has produced discoveries and achievements that pseudoscience could never have dreamed of. Science is always open to revision with new findings recognized as preliminary and requiring additional verification before being accepted as probably true. This is compared to the static character of pseudoscience that doesn't change in light of new evidence and don't increase knowledge of its subject matter; astrology in 2024 is essentially identical to the astrology of 1724.

After describing several of modern science's impressive discoveries (such as the discovery of gravity waves and the cause of the "biggest mass extinction in history"), Frazier highlights an ongoing controversy in geology over whether a reversal of the Earth's magnetic field over 40,000 years ago was responsible in part for the disappearance of large mammals from some areas of the world. One group of scientists published a paper suggesting such an effect. The paper was severely criticized by another group, and the original investigators then responded. One might wonder whether it would be a good thing to describe such scientific disagreements, but Frazier beautifully uses this episode to illustrate the way real scientists hash out the truth. "This is how science works. New findings are subject to rigorous criticism. They prevail only if they can stand up to them" (12). In pseudoscience, nothing of the sort happens.


SHADOWS OF SCIENCE
HOW TO UPHOLD SCIENCE, DETECT PSEUDOSCIENCE, AND EXPOSE ANTI-SCIENCE IN THE AGE OF DISINFORMATION
KENDRICK FRAZIER
WITH A FOREWORD BY RICHARD DAWKINS

Shadows of Science: How to Uphold Science, Detect Pseudoscience, and Expose Antiscience in the Age of Disinformation. By Kendrick Frazier. Prometheus Books, 2024.

The following three chapters expand on the themes started in the first chapter. Chapter 2 introduces the idea of *antiscience*, which differs from pseudoscience in that its practitioners actively deny the results of established science (i.e., global warming, the reality of COVID-19, the link between smoking and cancer) rather than establishing a new variety of bogus ideas. Frazier expands on this idea later in the book. Chapter 3 describes some of the characteristics of pseudoscience. Here he proposes an excellent definition of *pseudoscience* as "A set of strong ideas and assertions about the natural world unsupported or even contradicted by the best available scientific evidence and advanced as science without applying scientific methodologies" (26). What I find attractive about this definition is the inclusion of the idea of the scientific method. The question of the definition of pseudoscience returns later in the book.

Chapter 4, "What's the Harm? What Does It Matter?," takes up questions that almost all skeptics have been asked. Frazier points out that several areas of legitimate research have been hampered by a guilt-by-association effect of being perceived as in the same area as a pseudoscience. The clearest example is how the "worlds in collision" nonsense of Immanual Velikovsky caused problems for the field of planetary science. There is also the obvious problem of consumer protection. People who resort to alternative medicine are at higher risk of death than those who don't. Even if the issue is not a serious illness, wasting money on useless supplements and the like is a result of acceptance of alternative medicine claims. The book takes the harms of accepting pseudoscience from the personal level through policy decisions of governments.

The next few chapters take on specific pseudosciences and antiscience ideas. Chapter 5, "Subjects of Pseudoscience," describes the "shadows of science" that follow different areas of

real science (see also the cover story in the March/April 2023 issue of SI). Seven of the major areas of science are given with a list of the types of pseudoscience that follow these around like a shadow. Under "Astronomy and Space Sciences" we find over fifteen pseudoscientific shadows from "alien abductions" to "Velikovsky." By his own admission, these lists are not exhaustive; some items could easily be listed under different overarching scientific fields. It was heartening to read of the importance of understanding the psychological, cognitive, and perceptual aspects of acceptance of pseudoscience. When these processes go wrong, they produce phenomena that can convince individuals to accept invalid beliefs. Frazier also emphasizes the importance of having trained investigators, such as magicians, involved in investigations. The latter part of the chapter discusses hoaxes, conspiracy theories, and denialism (i.e., denying the Holocaust). At the end, Frazier makes a point that has not received the attention it deserves: Pseudoscience can be like a chameleon, changing not their colors but their names to avoid a history of disconfirmation. He mentions creationism becoming intelligent design. Others are facilitated communication morphing into "supported typing" and "rapid prompting method" and cold fusion becoming "low energy nuclear reactions." Identifying old, spoiled wine in new bottles is part of the skeptical mission.

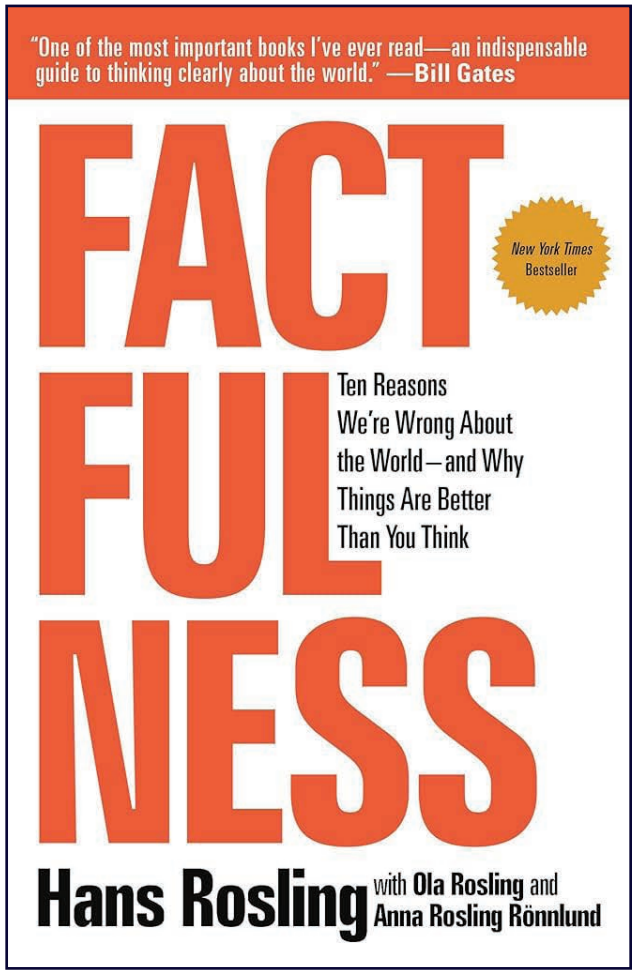
Chapter 6 returns to and expands upon a topic introduced in chapter 4: so-called alternative medicine, a.k.a. SCAM. The chapter uses some of the recent notorious alternative medicine celebrities promoting quackery to highlight the problems with SCAM. Featured prominently are Dr. Oz, Jenny McCarthy, Gwyneth Paltrow, and no less a royal person than King Charles III, referred to in the text as Prince Charles because it was in his princely role that he was so vocal and supportive of health frauds. Also featured are some of the heroes who have spoken out against SCAM, such as Paul Offit and Edzard Ernst. The reader is reminded once again of how downright pseudoscientific many products peddled by Paltrow are.

Probably many nonscientists view science, and scientists, as closed minded, proud, and full of hubris. Chapter 7 challenges this sort of stereotype. First, modern scientific research very rarely involves a lone scientist; rather, it is a collaborative process involving many individuals. Second, scientific research starts with uncertainty and, as more research is done, the uncertainty is reduced but never eliminated. Pseudoscience is filled with certainty, never changing despite contrary findings. Frazier makes an observation that will probably surprise nonscientist readers: Scientific communications, written or oral, are often filled with acknowledgments of the uncertainty of the findings being reported. But one almost never hears something similar from a pseudoscience proponent. No astrologer is likely to say, "My recent research may indicate that politicians born when Mars is ascending into Gemini are more likely to become stamp collectors, but the data is not yet definitive and more research is needed, especially to tease out the problems of those who collect both stamps and coins."

In chapter 3, Frazier proposes a definition of pseudoscience that highlights some of its important characteristics. That chapter did not tackle what philosophers call the "demarcation problem," how to distinguish between real science and pseudoscience. Chapter 8 deals with this issue at some length. Much philosophical ink has been spilled on this problem, starting with Karl Popper's argument in the 1950s that unfalsifiability was a major characteristic of pseudoscience. Since then, it has become clear that unfalsifiability is not the only characteristic of pseudoscience. Some belief systems that are clearly pseudoscientific are falsifiable. In this latter category fall astrology and biorhythm theory, both of which are easily tested. I found the chapter a good overview of the philosophical issues in the demarcation problem. Frazier covers the philosophical ground from those who think the problem is an important one to those, such as Larry Laudan, who think that it is impossible to distinguish between real science and pseudoscience. I sort of agree with this, but only if by *distinguish* one means to draw a hard and fast dividing line. But who cares? Such hard and fast dividing lines are fantasies in the real world made up of fuzzy sets. The sensory psychologist S.S. Stevens noted in another context that it is impossible to draw a hard and fast line between day and night, but that does not mean that day and night are not different.

The antiscience of climate change denial is the topic of chapter 9. It is an excellent overview of the major flaws in the antiscience arguments on this topic. I have not followed this issue as closely as I should have and so found much of interest in the chapter. Did you know that "*The world has not had a cooler-than-average year since 1976. In fact, it hasn't had a cooler-than-average* month *since 1985!*" (153, emphasis in the original)? I didn't. An especially interesting part of the discussion covers the attempts by the fossil fuel industry to sow doubt by misleading the public about the evidence for climate change.

As far as I know, little has been written about the history of skepticism in the twentieth century. Frazier was very much involved in this history, having been the editor of the Skeptical Inquirer from 1977 until his death in 2022. From 1971 until 1977, he was editor of *Science News*, and in that position, he covered much of the happenings in the skeptical community. He was thus well-positioned to write about the development of organized skeptical responses to pseudoscience. Chapter 10 deals with the history of skeptical organizations in the United States while chapter 11 covers the international aspects of the story. I was tangentially involved in the early years of the American skeptical movement as a graduate student at the University of Oregon from 1973 to 1978. Ray Hyman, one of the founders of the Committee for the Investigation of Claims of the Paranormal (now CSI, the Committee for Skeptical Inquiry) was one of my advisors. It was an exciting time, and Frazier captures that excitement well.


"One of the most important books I've ever read—an indispensable guide to thinking clearly about the world." —Bill Gates
FACTFULNESS
New York Times Bestseller
Ten Reasons We're Wrong About the World—and Why Things Are Better Than You Think
Hans Rosling with Ola Rosling and Anna Rosling Rönnlund

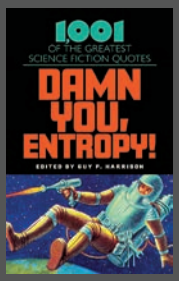
The last chapter is a coda for the book. Frazier returns to the theme of how real science produces real benefits for humankind while pseudoscience produces nothing but smoke and mirrors. He then looks to the future and takes an unexpectedly optimistic approach. To this end, he briefly summarizes two books that have influenced his optimism—Hans Rosling et al.'s *Factfulness* and Steven Pinker's *Enlightenment*. Both books argue, based on real data rather than scare headlines, that the world is becoming a better place despite what we might think. Relying on what is known about how dramatic scare headlines stick in memory, over the more mundane, often statistical, information about improvements, an example of confirmation bias, Frazier sees the world as improving. He strongly criticizes the progressive mindset as being overly pessimistic and suffering from "progressophobia." This phobia "is a powerful resistance, if not to achieving progress, then to realizing we *have* achieved progress" (210). In this regard, he cites evidence that, while objective statistics show that things have improved, the media coverage has been gloom and doom. ■

Terence Hines is professor of psychology at Pace University and author of *Pseudoscience and the Paranormal*. He is a CSI fellow.

[NEW AND NOTABLE BOOKS

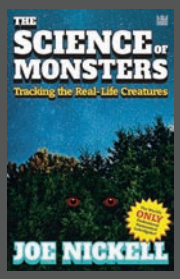
Edited by Stephen Hupp. Listing does not preclude future review.

BITCH: The Journey of a Word. Linguist Karen Stollznow's new book, due out in July, "traces the colorful history and ever-changing meaning of this powerful and controversial word." As described on the *Monster Talk* podcast (cohosted by the author), there are "lots of skeptical angles" to this book. Cambridge University Press, 2024.

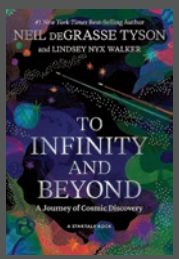


DAMN YOU, ENTROPY! 1,001 of the Greatest Science Fiction Quotes. This new book by journalist Guy P. Harrison (the author of the previous issue's cover story) presents a collection of notable science fiction quotes. For example, in *Prelude to Foundation*, skeptical hero Isaac Asimov quipped: "It's better to make a good future than predict a bad one." Prometheus Books, 2024.

GO TO HELL: A Traveler's Guide to the Underworld. Science writer (and CSICon speaker) Erika Engelhaupt's new book, due out in August, gives you the chance to "add hell to your travel bucket list with more than fifty one-of-a-kind underworld destinations, from ghost towns where Halloween is always in season, to ancient caves long viewed as entrances to Hades, to volcanoes that brim with fire and legend." National Geographic, 2024.



THE SCIENCE OF MONSTERS: Tracking the Real-Life Creatures. Authored by SI's superstar columnist, CSI Senior Research Fellow Joe Nickell's new book "takes readers from the depths of the seas to the heights of the Himalayas, using science and skepticism to separate fact from fiction." The "detective of the impossible" has struck again. Monster House, 2024.



TO INFINITY AND BEYOND: A Journey of Cosmic Discovery. Published toward the end of 2023, CSI Fellow Neil deGrasse Tyson cowrote this book with *StarTalk*'s senior producer, Lindsey Nyx Walker. The summary promises that "the farther out we travel, the weirder things get." Topics include "the spookiest phenomena of the cosmos: parallel worlds, black holes, time travel, and more." National Geographic, 2023. You can see Tyson speak live at CSICon 2024 this year!

FUN & GAMES

Edited by Stephen Hupp

YOU CAN FIND THE ANSWERS TO THESE GAMES IN SECRETS REVEALED (P. 66).

1	2	3	4
2			
3			
4			

Find 3 groups of 3 connections...

MEGA-MOUTH	SHARK-BOY	SHARK-TOPUS
JABBER-JAW	SHARK-NADO	COOKIE-CUTTER
JAWS	GOBLIN	BRUCE

CONNECTIVITY

These words can be divided into 3 groups, each with 3 words. Your brain is great at finding patterns – sometimes this helps, but other times it hurts! Write your guesses here:

SKEPTICROSS

ACROSS

1. Devices used on Phelps's back
2. Response of most Olympic gods when Zeus gives commands
3. Symbol of streaming service with an Olympic series called *Sprint*
4. Moussambani's first name (he was a notable swimmer in the Sydney Olympics)

DOWN

1. Myth: chiseled abs always equal a strong ___
2. The term ___*mensch* might be applied to Olympic athletes
3. Popular foot treatment for runners
4. Biles on the twisties: when the "mind and body are simply not in ___"

ANTIQUE MALLARKEY

By Kenny Biddle

Acquired at the Trevose Flea Market in Bucks County, Pennsylvania, the Bermuda Triangle Game was released by Milton Bradley in 1975 (the year before the formation of CSICOP). The Bermuda Triangle, also known as the Devil's Triangle, is a large area in the Atlantic Ocean. The points of the triangle include Miami, Florida; San Juan, Puerto Rico; and, of course, Bermuda. The term was coined in 1964 when author Vincent Gaddis wrote the article "The Deadly Bermuda Triangle" for the Argosy magazine, which told of "this particular slice of the world that has destroyed hundreds of ships and planes without a trace." The game has players transporting cargo via ships while trying to avoid "a big, bad mysterious cloud that turns and travels in all directions" causing ships to disappear. The game description on the box asks, "Can you make it 'HOME' with your cargo, or will your fleet become just one more VICTIM IN THE BERMUDA TRIANGLE?"

HOT TAKES

Ghostbusters: Frozen Empire

I'm a longtime fan of the Ghostbusters franchise, so on a rare occasion, I went to a theater to see the latest film, *Ghostbusters: Frozen Empire*. I found it to be just okay—not great and not bad—just … okay. This sequel to 2021's *Afterlife* moves the main cast of characters from Summerville, Oklahoma (the setting of the previous film), back to the original firehouse in New York City. Although this was a nice nostalgic callback to the original film, it (and other nostalgic details) was not enough to hide the overall slow and uneven pace of the film. The last twenty minutes had the bulk of the action crammed together in a short and anti-climactic final battle. I found Kumail Nanjiani, who seems to play the same character in everything he's in, an annoying distraction, and the film had weak mythology, including that of the main character, hero of science Pheobe (played by Mckenna Grace). It also detracted from the overall message I've always felt from *Ghostbusters*—that science will ultimately triumph over the supernatural. Although this was basically how the big baddie was defeated, the fight was forgettable.

Kenny Biddle
Chief Investigator, CSI
Host, *The Skeptical Help Bar*

Godzilla Minus One

I am blown away. What an amazing film. The emotions are real, raw, and deeply engaging without relying on humor. And what a brilliant lens to examine the psychology of post–World War II Japan. And so humanizing. A monster movie has no business being this good! (This Hot Take originally appeared on social media and is printed with permission).

Ross Blocher
Cohost, *Oh No, Ross and Carrie!*

Late Night with the Devil

This quirky horror film captures a very specific era in American history when moral panics coincided with ratings-driven sensationalism on broadcast television. It follows a talk show host desperate for ratings who decides to invite psychics, skeptics, and a possessed teenager on the show for a live exorcism. The token skeptic is clearly modeled after James "The Amazing" Randi, and it's fun to see him interact with the other guests. The subtext of synergistic exploitation is hard to miss. Television needs content to fill time—the more sensational the better. Psychics and parapsychologists want exposure, well aware that even a mediocre ten minutes on a D-list talk show is a gold mine in free advertising. The film gets a little clunky in spots but overall is a hell of a good time. (For a full review visit centerforinquiry.org).

Benjamin Radford
Deputy Editor, *Skeptical Inquirer*
Cohost, *Squaring the Strange*

SECRETS REVEALED

DID YOU NOTICE THE SHARK ON THE FRONT COVER?

Connectivity Answer

Group #1: *Jaws*, *Sharknado*, and *Sharktopus* are movies about sharks. Other notable movies include *Planet of the Sharks*, *3-Headed Shark Attack*, and *Ghost Shark*.

Group #2: Jabberjaw, Sharkboy, and Bruce (*Finding Nemo*) are fictional shark characters. Other notable shark characters include Sharky the Shark Dog, the shark that ate Samuel Jackson, and the shark jumped by Fonzie.

Group #3: Megamouth shark, goblin shark, and cookiecutter shark are real types of sharks. Other notable real sharks include the green lanternshark, the Pinocchio catshark, and the ghost catshark.

Skepticross Answer

1 C	2 U	3 P	4 S
2 O	B	E	Y
3 R	E	D	N
4 E	R	I	C

Peek Inside the *Bermuda Triangle Game*

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